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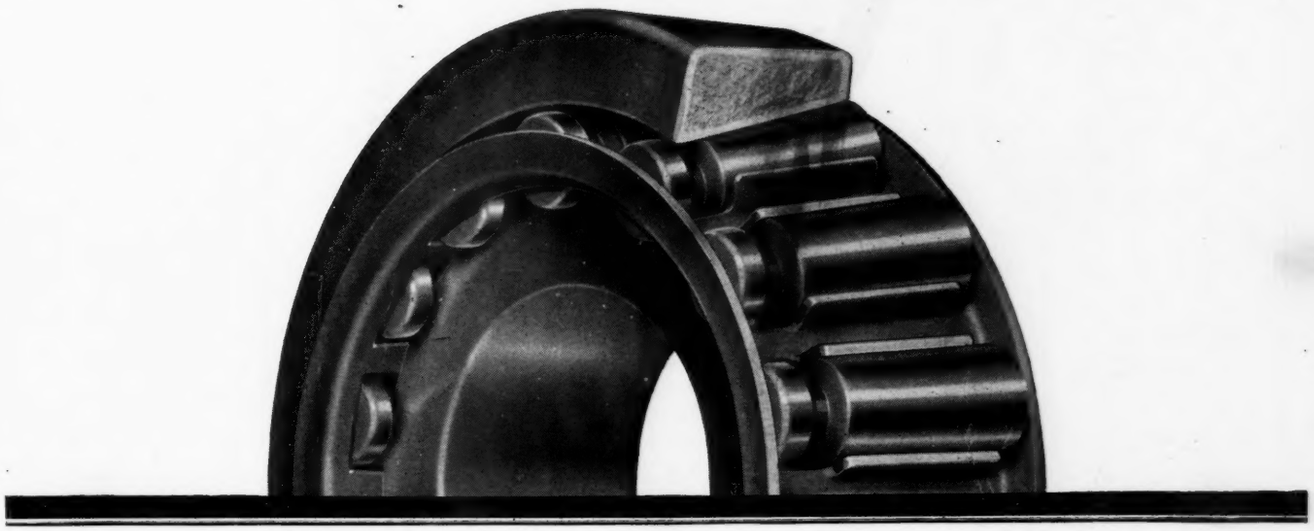

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WALTHAM SPEEDOMETERS

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THIS advertisement is one of a series now appearing in a wide list of newspapers covering the leading cities in America, in which the merits of Waltham Speedometers and Automobile Time-pieces will be brought to the attention of car owners.

AND AUTOMOBILE TIME-PIECES

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLIV. NEW YORK—THURSDAY, APRIL 21, 1921 No. 16

Balancing Factory Equipment for Efficient Manufacture

Team work is as necessary in a factory as in a ball team. Only by cooperation of all units can production costs be properly adjusted. In the production scramble many stars were bought. Now comes the era of specially equipped all-star factories.

By J. Edward Schipper

NOW that automobile manufacture has reached a production basis again, with factory output ranging from 25 to 100 per cent of capacity, machine problems are coming to the front. In many plants the production manager finds his machine tool equipment out of balance. This is due to the accumulation of new machinery during the past year or two in some departments, while in other departments, in the same plant, older machinery is relied upon. The result is that the shop is not producing uniformly, or up to profitable efficiency.

To put the situation in a nutshell:

The next year in the automobile industry must be one of intensive retooling if automobile manufacturing costs are to be adjusted to the general business trend. From the present outlook, there is not much to be hoped for in any material reduction in labor costs. Wages are apt to remain indefinitely about where they are, and if manufacturing costs are to be cut it must be on a production side, or, in other words, by the use of better machinery adapted to manufacturing at higher speeds.

It may astonish some manufacturers to know that, from the machinery standpoint, their plans are practically obsolete. It would be perfectly possible with up-to-date tool equipment to manufacture a greater number of automobiles in the same space and time by the use of new machinery. **Naturally, a manufacturer equipped with this machinery would be in a position to undersell the concern with the older tool equipment.**

This is clearly brought out by a visit to factories which have been partially re-equipped with machinery.

> **There is one particular engine which the writer has in mind in which it is necessary to run one machine only two hours in order to keep production up with the rest of the shop. This either means that the manufacturer had no right to buy the improved machine, or he is losing money by not re-equipping his factory to the production schedule of his most advanced machine. A machine cannot pay its carrying cost by two hours' work.**

There is another, and a very important, advantage in the purchase of improved machinery to replace older models. **This is in the greater accuracy of the new machine and the consequent saving, not only in the matter of rejections of partially machined parts, but also in the inspection department.**

The problem in retooling a plant is broadly economic in the many angles it presents for consideration. Between the time a piece of raw material enters the plant and the time it leaves the factory, as a finished product, this piece of material is costing the manufacturer money. Naturally, the shorter he makes this period, the less his cost of production will be. He will have saved money by shortening the labor charges; by increasing the rapidity of turnover and by reducing the amount of money tied up in parts in process.

The efficiency of the machinery in the plant has a direct bearing on the ratio of output to process parts. Consequently it is a direct factor, not only in the cost of the finished article, but in the amount of working capital required to run the manufacturing business.

When these factors are taken into consideration and when it is considered that a great many of the automobile plants in successful operation are using the machinery purchased from 5 to 10, and in some cases 15 years ago, this question of retooling becomes one of the biggest problems within the industry.

Now that the cost of machine tools is back on a basis where purchase is readily justified when the economic consideration of the plant demands it, the time has come when every manufacturer should ask himself if his machine tool equipment is such that he is getting as large a return for the money invested in manufacture as his new competitor, who is tooled up along more modern lines.

If it is true that a new manufacturer could enter the field with a new plant and make the same or a better product at less cost, there is something wrong with the tool equipment of the older concern.

It has been stated before in these columns that there are certain automobile manufacturers who are admittedly giving a greater value to the public on a dollar per dollar basis than other manufacturers. A study of the reason entering into this shows that it is largely a question of manufacturing equipment. Manufacturers whose plants have been developed and maintained at a modern standpoint can turn out a greater quantity of cars at a less price and with a smaller amount of floor space than plants using older equipment.

Drill presses are a good example of this. It would not be far wrong to state that the drill press equipment of the automotive industry is about 30 per cent behind times.

In other words, if the entire mass of drilling operations for the entire industry were considered in bulk, it would be possible to drill the same number of holes in the same length of time with only 60 per cent of the number of machines now utilized and in 60 per cent of the space. This is an arbitrary figure, but well within what machine tool men know to be a fact.

The advance in the machine manufacturers' art during the past three years has been far greater than the advance in engineering in the automobile field. From a performance standpoint, the automobile of to-day is fairly satisfactory from the viewpoint of the consumer. To-day an automobile is discarded, not because it ceases to respond to the demand for transportation, but because it becomes noisy, somewhat more expensive to operate and chiefly because of the pride of the owner. This being the case, we must not look to the designer for the big improvements in the automobile industry during the next few years. These improvements will be rather in the manufacture of the product and in the material chosen than in design engineering.

It is hardly likely that any revolutionary engineering discoveries will be made within the next few years that will entirely shake the foundation of the art, so far as performance is concerned. **On the other hand, it is entirely possible to look for revolutionary improvements in the matter of manufacture and, as a matter of fact, these revolutionary improvements have largely taken place during the last three years.**

New machines available to the automobile manufacturer, if he studies the machine tool market, are further ahead of the tools which he has had in his plant for the past 5 or 10 years, than the cars of to-day are ahead of those of 10 or 15 years ago.

The long pauses between cutting operations have been eliminated and on many of the tools now on the market, particularly for milling and grinding operations, there is hardly an instant during the working day when the tool is not cutting. A tool reaches its maximum earning capacity **when it is cutting at the highest possible cutting speed during the entire working day.** This ideal, of course, has not often been attained, but is so nearly accomplished on some of the newer machines that the advance in manufacturing efficiency is surprising.

It is not difficult to look through the cost figures of the automobile manufacturer and find where such machinery will save money. Furthermore, unless new tool steels are invented which make it possible to cut at a faster rate than is now possible, the manufacturer is assured that just as long as he has machine tools which are continually cutting at that rate, he will be in a position to manufacture that particular piece with the greatest efficiency.

Accuracy of manufacture has come with the new machinery for a variety of reasons.

One example is in the simplification of locating points which has been rendered possible by the ability of machines to operate at several points on the piece at the same time. With the older equipment, it was necessary to twist and turn the piece so many times during the process of machining that location from secondary locating points was often required. The impossibility of maintaining accuracy under such conditions is readily recognized by all manufacturers.

Furthermore, the machinery which is capable of the greater number and the greater rapidity of cuts has been made far more rigid than the older machinery, which is another factor in the increase in accuracy.

As a third factor in promoting accuracy, the machinery is very often adapted to much simpler and better forms of jigs, and furthermore, particularly in the case of the drilling operations, the same jig can often advantageously be passed from one machine to the next, so that not only is time saved in eliminating the necessity for removing the piece from one jig and placing it in the next for succeeding operations, but also absolute accuracy is assured in the spacing of drilled holes and in their location.

There is no intention here to go into the detail of improvements which have been made in the various classes of machinery, but it is desired to point out the fact that manufacturers who are not keeping themselves fully posted on improvements in machine tools (which can improve the speed and accuracy of manufacture of their products) are leaving an opening for their competitors.

Buying a machine tool is very much the same sort of problem as that of buying a truck to solve a transportation problem. The purchaser must not consider that he is buying a mere piece of machinery. He must take the view that he is buying the service which it renders. As a man buys a truck to trans-

port goods from one place to another, he naturally overlooks the first cost of the vehicle and figures it in the transportation costs over the period during which the truck is in action. This, of course, is the only logical basis upon which the truck should be bought.

In the same way, the manufacturer must not forget that in buying machinery he is buying manufacturing ability, with the cost of the machinery spread over period during which the machine will serve him.

Now that engineering and design have reached a basis where the fundamentals of a design are unlikely to be radically changed for several years, the matter of tool equipment can be approached in an entirely different attitude than it could have been during the period when the manufacturer was forced to bring out practically a new model every year in order to keep pace with the engineering. In those days the manufacturer looked askance at a single purpose piece of machinery. He knew that such a machine would have to be discarded, or at least converted at a high cost at end of the year.

To-day the proposition is entirely different. When a model has been designed and approved after exhaustive laboratory and road tests, and the manufacturer is sure that what he has is the best that modern engineering brains and skill can produce, he knows that he has to equip his factory to manufacture that particular model over a period of years.

For this reason he can afford, in these days, to purchase machinery which will enable him to get the utmost in production for any given period. Where a special machine will do better than a stock product, he is justified in purchasing such a special machine because of its better ability to handle a particular part efficiently.

Any student of the industry knows that we are entering a period of sharp competition. Sharp competition naturally means that price will be a deciding factor. The manufacturer with the best machine tool equipment is in a position where he can furnish the best possible article at the lowest possible price. All other things being equal, this means that he is going to get the business.

An American Floatless Carbureter

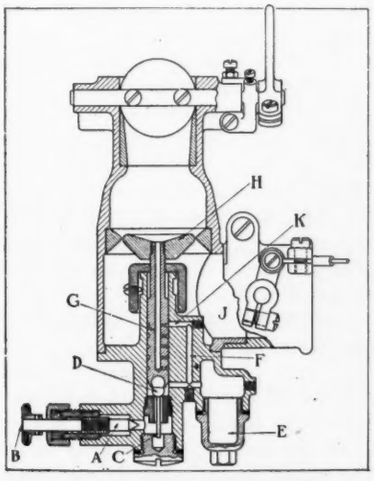
FLOATLESS carbureters seem to be the object of some interest in Europe, to judge by the recent article on German carbureters in AUTOMOTIVE INDUSTRIES. The accompanying illustrations show the LaFehr floatless carbureter, which is now being manufactured in Detroit, where tests of it are now going on in various laboratories. This carbureter depends almost entirely upon velocity head for its operation. It does not use hot air, but tests already made are said to indicate unusual starting ability in cold weather with ordinary present day fuel.

Referring to the sectional drawing, it will be seen that the fuel enters the passage *A* from the tank through the usual type of connection. A needle valve with milled head *B* controls the flow into the passage *C* below the jet. Cranking the engine relieves the ball check *D* which is part of the metering pin *G*. Gasoline flows past the ball check valve, now lifted off its seat, into the chamber *E* and also into the passage *F*. If the engine is running at high speed and the suction is sufficient, the fuel in chamber *E* is exhausted and all of the fuel passes up through the chamber *F* at very high velocity. On shutting off the motor, the chamber *E* is again filled, the function of this chamber being to prevent pumping of the gasoline, due to the rising and falling of the metering pin *G* and to furnish a starting and acceleration supply.

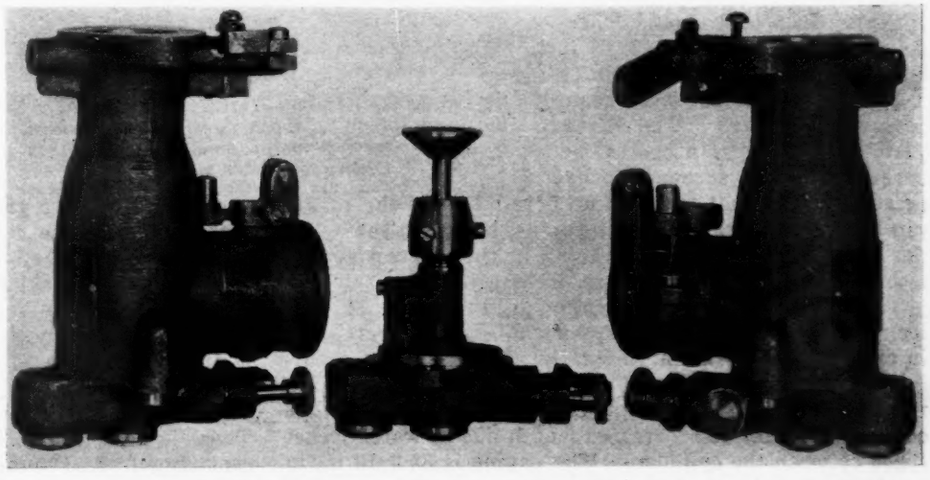
In normal operation, the fuel makes right angle turns at *C*, at the point of leaving the ball check, at the point of entering the passage *F*, at the top of the passage *F*, and again after entering openings in the metering pin *G*. There are a number of these openings which register with the passage *K*. As the suction of the engine increases, the cone *H* at the top of the metering pin is lifted higher, allowing the graduated jets to register successively with the port *K*. This increases the fuel supply in proportion to the demands of the engine. Air enters through the passage *J* and passes the cone *H*, which gives it a whirling or vortex effect. The metering pin *G* is grooved at each of the openings so that if it turns on its seat there is no interference with the flow from the port *K* into the proper opening in the metering pin *G*. The fuel issues from the center of the metering pin and the mixture occurs immediately above the cone *H*, where the fuel is picked up by the air stream.

The atomizing effect, due to the extreme velocity of the fuel and the right angle turns in the direction of flow; together with the sudden change in pressure on leaving the jet is claimed to be very considerable.

The LaFehr Floatless Carbureter Sales Co. is to handle the retail sales. The manufacturers' equipment business will be taken care of by the Detroit Carbureter Corp.



Vertical section through LaFehr carbureter



The LaFehr floatless carbureter, showing in the center the detachable metering unit

Non-detachable Head Used in New Stock Engine

Has four cylinders, 3¾ by 5 in., and develops a maximum of 48 hp. Both halves of crankcase and water jacket cover are aluminum castings. Valve caps are screwed into cylinder head. Full pressure lubrication employed.

By J. Edward Schipper

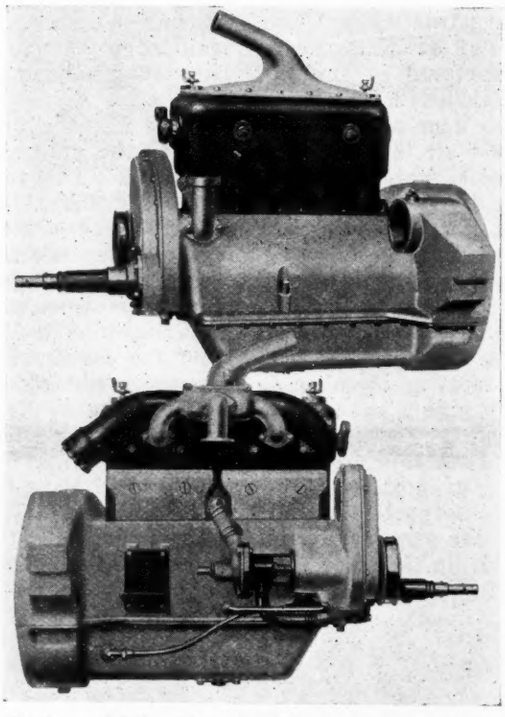
THE engine here described and illustrated is of the four-cylinder L-head type suitable for light truck or passenger car work. It has a bore and stroke of 3¾ by 5 in., giving an S. A. E. rating of 22.5, but develops a maximum of 48 hp., or about 1 hp. for every 4.6 cu. in. displacement, the total being 221 cu. in.

The engine is a universal type in that it will take any standard equipment. For ignition any standard make of magneto or distributor can be fitted, the carbureter flange is a 1 in. S. A. E. standard vertical type, the generator mounting a No. 1 S. A. E. flange, the starter mounting an S. A. E. standard barrel type for Bendix drive.

In construction, the engine follows along straight L-head lines with the four cylinders cast in a single block of semi-steel. The upper and lower halves of the crankcase are cast separately, both parts being of aluminum. The cylinder head is non-detachable, but the jacket cover is detachable and is of aluminum. The extensive use of aluminum in this engine gives a fairly light weight design, the total weight of the entire powerplant being 425 lb.

The pistons are of the three-ring type, all three of the rings being above the piston pin. They are grey iron castings 3¾ in. in length. The rings are 3/16 in. in width. The piston pin is 1 3/32 in. in diameter, of seamless steel tubing, locked in the piston pin boss by a special set screw. This set screw is locked in such a way that there is no possibility of the piston pin becoming loose and coming in contact with the cylinder bore. The piston pin bearing in the connecting rod is bronze bushed and is 1½ in. in length.

The connecting rods are I-section drop-forgings, 10½ in. long, center to center. The lower rod bearings are 1⅞ in. in diameter by 2 3/16 in. in length. As a means of securing compactness, the center line of the big end connecting rod bearing is offset from the center line of the rod, thus compensating for the increased length due to water jacket space between the cylinders. The engine is 35 3/16 in. in length from the end of the front support to the rear face of the bell housing.

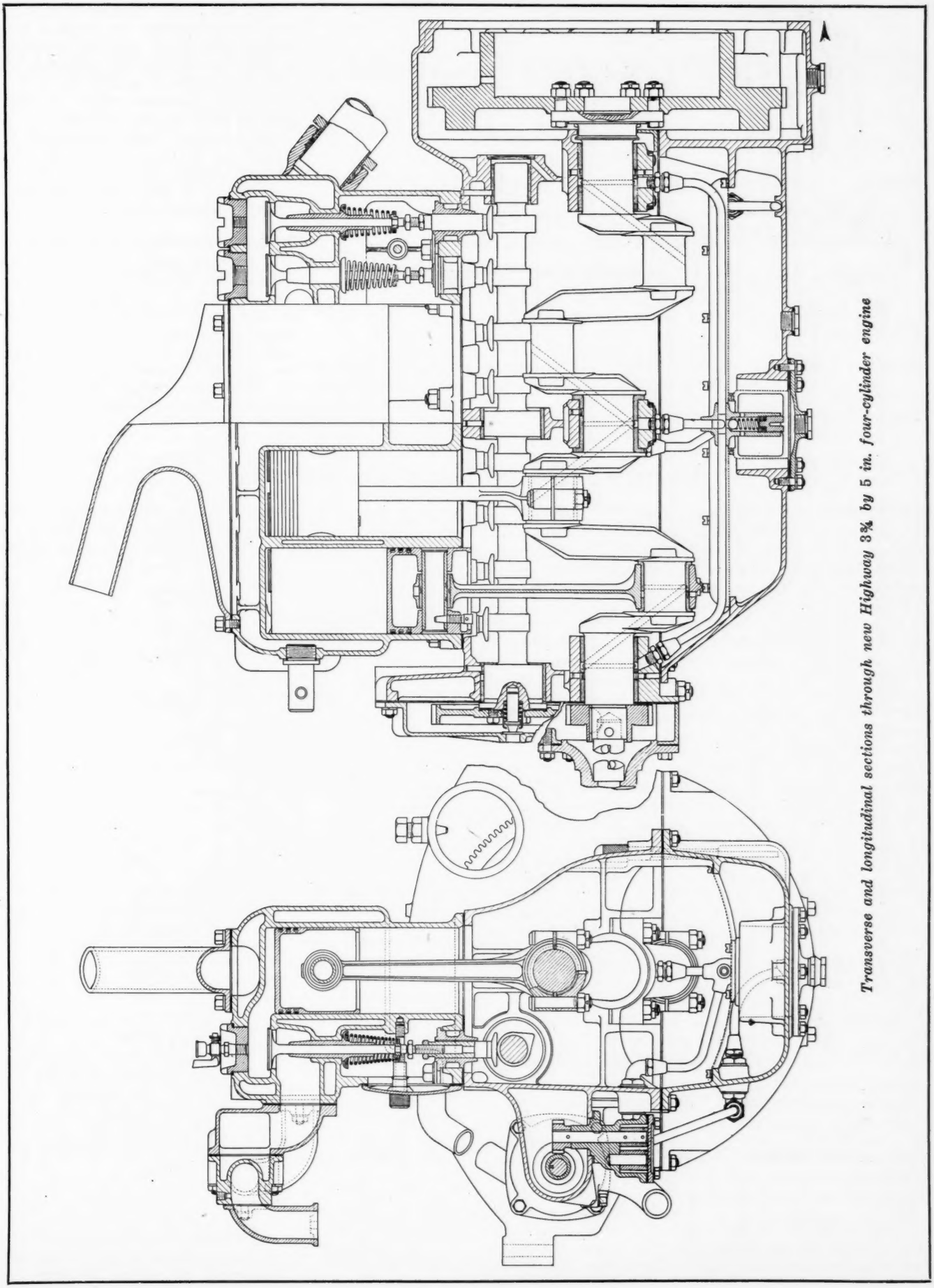


Right and left sides of Highway engine, showing the pump drive, manifolds, standard S. A. E. starting motor mounting and large diameter water outlet

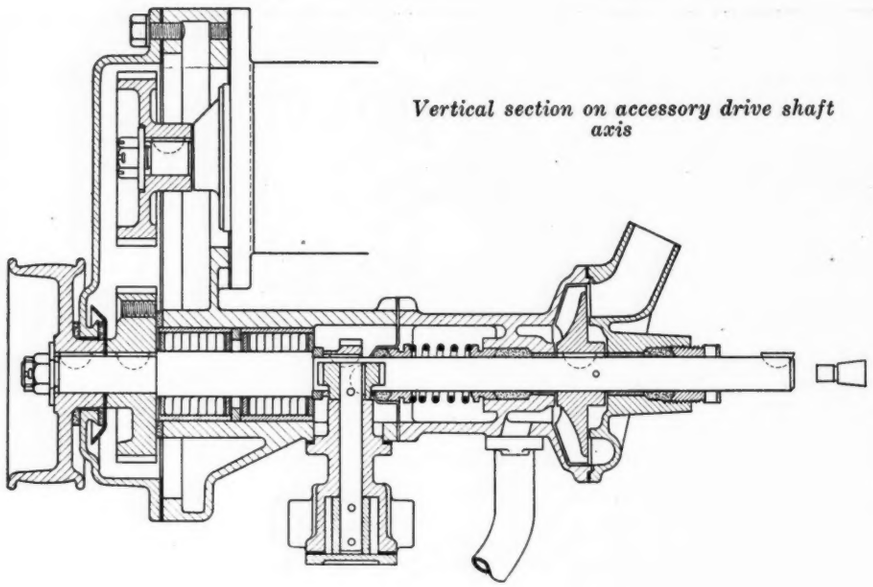
The crankshaft is carried on three main bearings which are supported in the upper half of the crankcase. The crankshaft bearing dimensions are (front to rear): 2 3/16 in. diameter by 3 in. length; 2 7/32 in. by 2½ in., and 2¼ in. by 3 in. This is an exceptionally large shaft diameter for the size of the engine and the shaft has sufficient rigidity to practically eliminate noticeable periodic vibration. The end thrust on the crankshaft is taken by flanges on the center bearing. The main bearings are bronze backed with babbitt lining, the white metal being doweled into the bronze. There is an oil thrower ring on the rear main bearing, working in a recess in the bronze bushing and an aperture in the crankcase, allowing the oil to drain back to the pan.

The timing gears are of the helical type, with ⅞ in. face. The camshaft is an integral forging mounted on three bearings. The dimensions of the camshaft bearings (front to rear) are as follows: 2 19/32 in. by 1⅝ in.; 2 9/16 in. by 1⅛ in., and 1½ in. by 1¾ in. This tapering in the size of the camshaft bearings permits of withdrawal of the camshaft endwise by removing the aluminum timing gear case at the front end of the engine. The camshaft end thrust is taken up by a spring and button attachment in the front end of the shaft. The valves are operated by flat, mushroom type tappets, the push rod guides being pressed in from the top. The valves have exceptionally long guides, which extend a considerable distance below the valve pocket. The clear valve diameter is 1⅞ in. They can be removed through valve caps screwed into the cylinder head.

The oiling is by full pressure to all of the crankshaft and rod bearings by a gear driven oil pump. The oil pump is in direct communication with the main bearings and thence by drilled leads with all of the lower rod bearings. The balance of the lubrication is taken care of by spray. There is no splash to any of the bearings. Cooling is by centrifugal water pump, the pump shaft being driven from the timing gears. The water spaces are exceptionally large, the inlet diameter being 1¼ in. and the outlet 2 in.



Transverse and longitudinal sections through new Highway 3¾ by 5 in. four-cylinder engine



Vertical section on accessory drive shaft axis

The intake and exhaust manifolds are bolted together to form a hot-spot construction and are mounted on the right side of the engine. The exhaust manifold bore is for a 2¼ in. outside diameter pipe. A ring gear is fitted on the flywheel.

The engine here described is shortly to be manufactured by the Highway Engine Co. in its own plant. Heretofore it has been manufactured in another plant.

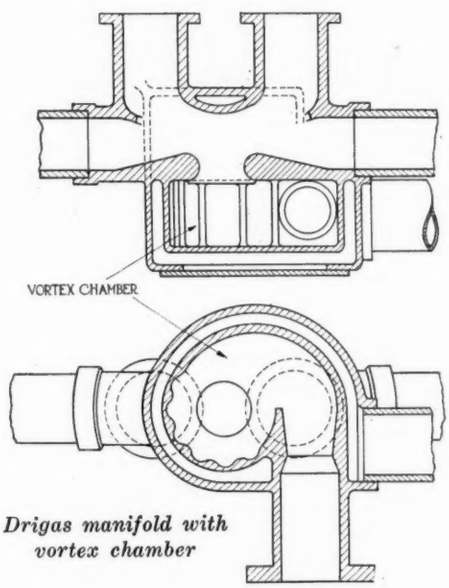
EXPORT figures for 1920 show an increase of 29 per cent in the number of American motorcycles sent to Spanish speaking countries. In 1919, there were 2780 motorcycles exported to these countries, while the 1920 total went to 3579. Spain was the largest consumer in both years, its 1920 consumption being 1416. Argentina ranked second with 597.

Exhaust-Heated Manifold Patents

ROBERT W. A. BREWER, an English engineer, has developed an induction system for internal combustion engines making use of relatively heavy fuel. Patents have been issued to him on this system, and the trade name of Drigas has been registered in Washington.

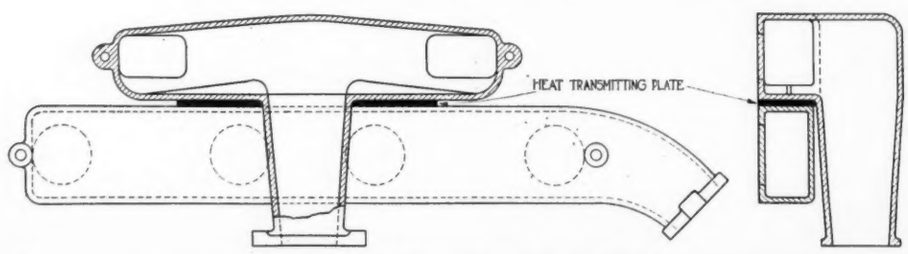
Brewer's first British patent was applied for on Dec. 1, 1913, and accepted Aug. 27, 1914. The specification shows a four-cylinder inlet manifold substantially of T form, in which the volume near the joint of the branches is increased with a view to damping out the fluctuations in charge speed due to the suction. Another feature is that there are no sharp edges at the junctions of the several parts, the inlet passage being relatively high at the center and sloping down toward the ends, but in order that any unvaporized fuel may drain back to the carburetor, there are provided two narrow channels having a slope toward the vertical part of the manifold. The upper side of the inlet manifold is in metallic contact with the wall of the exhaust manifold and therefore forms a sort of hot spot. As an alternative the upper side of the inlet manifold may be formed integral with the wall of the exhaust manifold.

The other patent referred to was applied for on Jan. 27, 1920, and issued on Dec. 23, 1920. The object of this invention is to provide a comparatively large heating area for the charge from the carburetor in a limited space. The charge enters a so-called vortex chamber, that is, a short cylindrical chamber with tangential inlet, which is completely surrounded by an exhaust jacket. The tangential inlet gives the gases a whirling motion in the vortex chamber, throwing any unvaporized particles against the cylindrical, exhaust-heated surface. The outlet from the vortex chamber is either at one end or both ends. The intention is to pass the gaseous mixture through the vortex chamber without materially increasing its temperature. The inner wall of the vortex chamber may be provided with low transverse ribs to increase the heating surface and break up the layer of unvaporized fuel. The outlet or outlets from the vortex chamber and the inlets to the branches of the manifold are restricted in area.



Drigas manifold with vortex chamber

The invention also refers to means for introducing an inert gas, such as exhaust gas, into the fuel stream entering the manifold during a period of low power development, to increase economy.



One form of Brewer's 1914 manifold

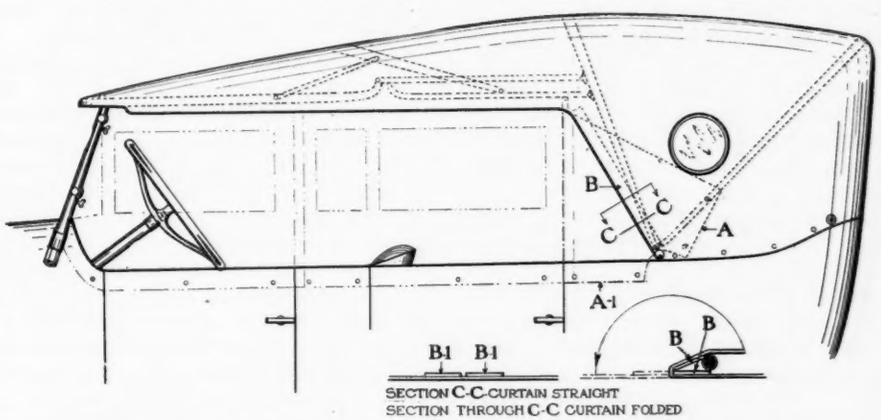
Design Problems in New Semi-Victoria Touring Top

There have been a number of cars recently equipped with a new type semi-victoria touring top, which presents some interesting problems of design. The following article discusses these problems and describes how they were solved by the writer in a particular case.

By George J. Mercer

SEVERAL car models seen for the first time this year are equipped with the new semi-victoria touring top, which presents for examination a number of interesting features. This type of top offers a completeness in appearance and a nicety of balance that is generally lacking where only the gypsy quarter is used. Some of the semi-victoria tops are equipped with detachable curtains so that the gypsy quarter can be used alone when desired.

The results of some recent experiments carried by the writer in connection with this top are shown in the accompanying diagram. The problem in this particular case was to provide some effective way of closing the triangular opening back of the rear door, without resorting to the use of a detachable curtain. The doors opened from the rear on this car and door curtain rods were used. A detailed discussion of the drawing will point out the way in which the problem was solved in this instance.



The semi-Victoria top with folding curtain described in the text

A and A-1 indicate the bottom edge of this curtain part as finally worked out in the two positions. The side is integral up the door line, where the door curtain laps over. The dot and dash line shows it assembled and the storm curtains in place, while the dotted lines show it folded back inside and fastened with a button to the rear bow. The round glass is set just above so that the fabric does not cross the line of vision.

B-1 and B-1 are reenforcements sewed inside the curtain with a space of about 3/32 inch between. This makes a natural hinge, so that the goods will fold with the minimum liability of cracking. Moreover, since no pressure is ever exerted at this point, such a curtain should last as long as the top.

The section through C-C shows some details of construction. The section at the right shows the flap turned back and fastened to the bow, while the section at the left shows how the folding operation is controlled. Through the method used a straight line is presented when the flap is back, thus giving to the top a pleasing and finished appearance.

There are several very definite advantages to be gained from folding the flap back in this particular manner. Among the chief of these are:

1. The flap is always in place for instant use.
2. There is one less curtain to attach than would be the case were a different method used.
3. A more finished appearance is presented on both sides, whether the flap is folded or open.
4. There is a saving in weight.
5. Less space is taken up in the storm curtain storage pocket.

Thoroughly satisfactory methods of storing curtains have not yet been evolved by manufacturers, even after many years of experience and experiment. One of the chief difficulties encountered has been the spoiling of celluloid when rolled or folded. For this reason, it has been necessary to discard curtains on rods and wires attached to the bows.

Some success has been attained by the use of a large flat pocket attached to the bows at one end. The difficulty with this arrangement, however, is that the curtains cannot be taken out or put away unless the passenger leaves the car.

Most of the new cars are using space at the rear of the front seats for this purpose. Considerable expense is attached to such a method, however, since the framing and the door cost more than does a roof pocket. Nevertheless, no means has been devised to equal it for practical service, so that its utility value well repays the added cost. The more general use of the five-passenger model, moreover, eliminating, as it does, the space necessary for folding seats, gives added room which may advantageously be devoted to curtain space.

The relative value of the service rendered to the cost of using a certain method will always constitute a nice problem, of course, which must be solved for each case.

Government Research in Road Construction

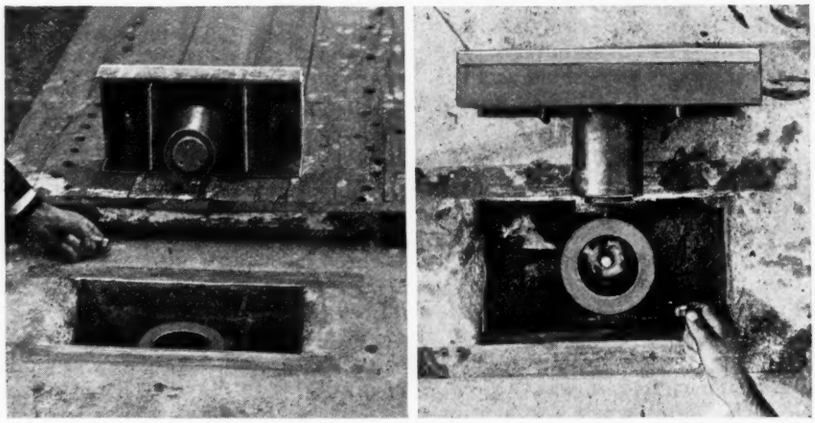
The road construction research work, being carried on by the U. S. Bureau of Public Roads, is discussed in detail by Mr. Heldt. The tests aim to enable engineers to predetermine the adequacy of roads. Impact and subsoil tests the subjects of exhaustive experiment.

By P. M. Heldt

ROAD building is one of the oldest engineering arts, dating back to the time of the Romans, and a large amount of technical data has accumulated on the subject. Unfortunately, however, little of it is directly applicable to modern road construction, for the reason that the character of road traffic has undergone fundamental changes during the past 20 years.

At the beginning of the present century the macadam road was considered a nearly perfect construction, and for light and moderately heavy horse traffic it served well indeed. Then came the high speed passenger automobile with its large size pneumatic tires and proved exceedingly destructive to these roads. The so-called suction of the tire as it left the road drew the binding material from between the stones, and the wind distributed it over the roadside and surrounding fields. After this had been going on for some time the road became rutty and defective and then quickly went to pieces. The solution of this problem was found in oiled roads and in tar macadam.

During the war period motor truck traffic over country roads first assumed considerable importance, and this led to another kind of road trouble. Most of the improved highways constructed in this country from 1900 on were built for light traffic, that of motor-propelled passenger vehicles being the class of traffic chiefly in view. These roads were not equal to the heavy concentrated pressure of the wheels of heavily loaded trucks, especially in spring time when the frost came out of the ground and the subgrade was unusually wet and soft. As a result they were rapidly ruined. Meanwhile large appropriations for road building were being made by many states, and it was realized that if these appropriations were to be spent to the best advantage it was absolutely necessary to make a careful study of the wearing or destructive effects of different kinds of road traffic, the wear and impact resisting qualities of different road surfacings, the bearing values of different subgrade materials, effectiveness of various drainage methods, etc. This research work was undertaken by the U. S. Bureau of Public Roads. Most of the experimental work is being carried out at Arlington, Va., a short distance from Washington, D. C. The work is in charge of A. T. Goldbeck, engineer of tests of the Bureau of Public Roads. Mr. Goldbeck has prepared a number of reports to the Department and papers for meetings of road engineers on the progress and results of the tests up to date, on which the following discussion is based.



Figs. 1 and 2—Two views of impact testing arrangement. Note copper cylinder in observer's hand

A Basis for Road Designs

It is the aim of these tests to establish the basis for a rational method of road design which would enable engineers to design roads with the same assurance regarding their adequacy for the traffic to be carried and their durability with which it is now possible to design bridges. The line of research work to be carried out was intended to bring to light all the basic facts bearing on road design. First it was to be determined how the impact varies with the speed, weight and tire equipment of a vehicle and with the relation between sprung and unsprung load. Another series of experiments was to determine the ability of road slabs of different materials and thickness to withstand such impacts, and finally the effect of the subgrade was to be investigated.

In the impact determination tests the rear wheel of a loaded truck is allowed to deliver its blow to the plunger of an hydraulic jack buried beneath the road. In some of the tests the truck wheel is allowed to drop off the end of a 2-in. plank directly onto the jack and in others it is driven over an obstruction in the form of a square sectional bar lying directly over the jack. The force of the blow is transmitted to a prepared copper cylinder, the deformation of which is a measure of the intensity of the blow. By subjecting the

Figs. 3 and 4—The two methods of making impact tests (drop test and obstruction test)

copper cylinder to successively increasing pressures in a testing machine and taking note of corresponding pressures and deformations, it is possible to effect a calibration. It is realized that this method does not give the force of the blow in absolute terms but it serves well as a practical method of comparison. The harder the blow, the greater will be the deformation and it stands to reason that the blow causing the greatest deformation of the copper cylinder would also have the most destructive effect on a road slab. Figs. 1 and 2 herewith show the hydraulic jack as buried in the road, the plunger being carried by a section of channel steel flush with the road surface. The observer holds in his hand the small copper cylinder on which the force of the impact is spent.

Several thousand impact tests with this apparatus have been made to date. It is obvious that the impact must depend on the weight of the truck, but it also depends on a number of other factors, including the relation of sprung to unsprung weight, the tire equipment, the characteristics of the spring suspension, the unevenness of the road, etc. The method of conducting the tests is illustrated in Figs. 3 and 4, the truck wheels dropping off the end of a 2-in. plank onto the jack plunger in Fig. 3 and passing over an obstruction on the plunger in Fig. 4. In Fig. 3, in order to prevent the front wheel from delivering a blow and thus deforming the copper cylinder before the rear wheel blow takes effect, a bridge piece is placed over the jack, which is withdrawn by an assistant immediately the front wheel has passed. A similar plan is put into effect when making the obstruction tests illustrated in Fig. 4.

Results of Impact Tests

A summary of the results obtained in these impact tests is given by the four charts of Fig. 5. In each of these charts the speed at which the truck passed over the impact testing device is plotted along the horizontal scale and the force of the impact, in thousands of pounds, along the vertical scale. Chart A permits of a comparison of the impact caused by trucks of different load capacities. It will be noticed that at the same speed the impact increases with the load capacity, being greater for the 5-ton than for the 3-ton truck, greater for 3-ton than for the 2-ton and greater for the 2-ton than for the 1½-ton. But the smaller trucks are capable of considerably higher speed and the maximum impact seems to be substantially the same for all trucks. Mr. Goldbeck, however, cautioned his hearers that this must not be taken as conclusive evidence that large trucks are no more destructive to roads than small trucks.

The influence of tire equipment is brought out in Chart B. All experiments recorded in this chart were made with the same truck, the only thing that was changed being the tire equipment. As would be expected, the impact is greatest with solid tires, least with pneumatic tires and intermediate with cushion tires. With the solid and cushion tires the blow due to passing over an obstruction varies substantially in direct proportion to the speed. With the pneumatic there is very little increase of impact with the speed while passing over an obstruction. While dropping off the end of the plank the impact with all forms of tire equipment increases with the speed up to a certain point, in this case between 12 and 13 m.p.h., after which it remains substantially constant. This is the minimum speed under which the wheel can drop freely under the action of gravity and the spring action. The deflection given in the chart is the flattening of the tire under the dead load on its wheel, which in this case was 4500 lb. It will be noticed that the greater the deflection of the tire under load the smaller the impact, which is exactly what would be expected. No investigation has yet been made of the effect of springing characteristics of the suspension on the impact.

Effect of Unsprung Weight

Chart C is intended to bring out the effect of the relation between sprung and unsprung weight. In this test two trucks were used, one having an unsprung weight of 1950 lb. and the other of 1350 lb. and both were loaded to the same total weight on each rear wheel (10,100 lbs.). The wheels were allowed to drop 2 in. and ½ in. and in both cases the wheel carrying the greater unsprung weight gave the maximum impact. Mr. Goldbeck, however, expresses the view that within the limits of present truck design the influence of differences in the relation of sprung to unsprung weight is not sufficient to influence road design. But he urges truck designers to keep down the unsprung weight to a minimum, as this will reduce road wear. Fortunately, the truck designer has a reason of even more direct importance to him to keep down his unsprung weight because a high ratio of unsprung to sprung weight is also very destructive to tires.

A comparison of the blows struck a road slab by solid and pneumatic tires, respectively, mounted on trucks of 5 tons capacity, is made in Chart D. It will be noted that a solid tired wheel passing over a ½-in. obstruction delivers a heavier blow than a pneumatic tired wheel passing over a 4-in. obstruction. At moderate speeds with pneumatic tires the blow increases with the air pressure, but at rather high speeds the blow is greater with low than with high pressures of inflation. Here

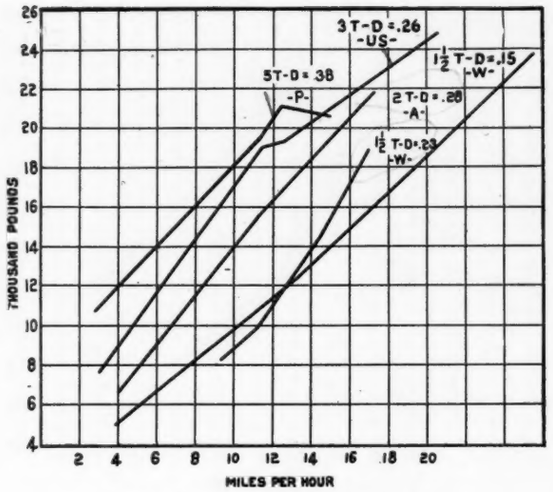


Chart A COMPARISON OF TRUCKS
TIRE DEFLECTIONS INDICATED ALL 2" OBSTRUCTIONS

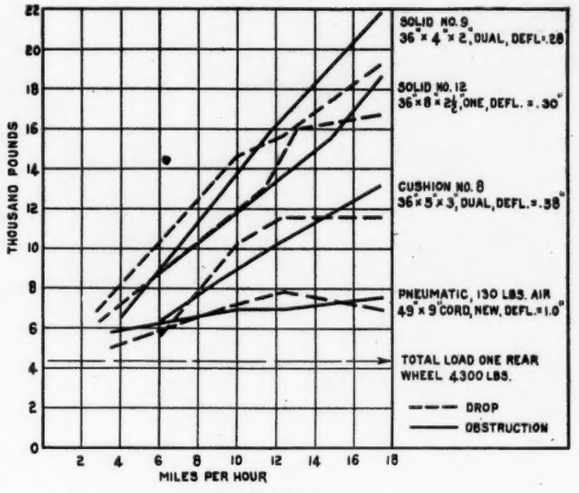

SOLID NO. 9
36" × 4" × 2", DUAL, DEFL. = .28"
SOLID NO. 12
36" × 8" × 2½", ONE, DEFL. = .30"
CUSHION NO. 8
36" × 5" × 3", DUAL, DEFL. = .38"
PNEUMATIC, 130 LBS. AIR
4.9" × 9" CORD, NEW, DEFL. = 1.0"
TOTAL LOAD ONE REAR WHEEL 4300 LBS.
DROP
OBSTRUCTION
THOUSAND POUNDS
MILES PER HOUR

Chart B COMPARISON OF TIRES
2 TON TRUCK A
LOAD, 2 TONS U = 1000 LBS

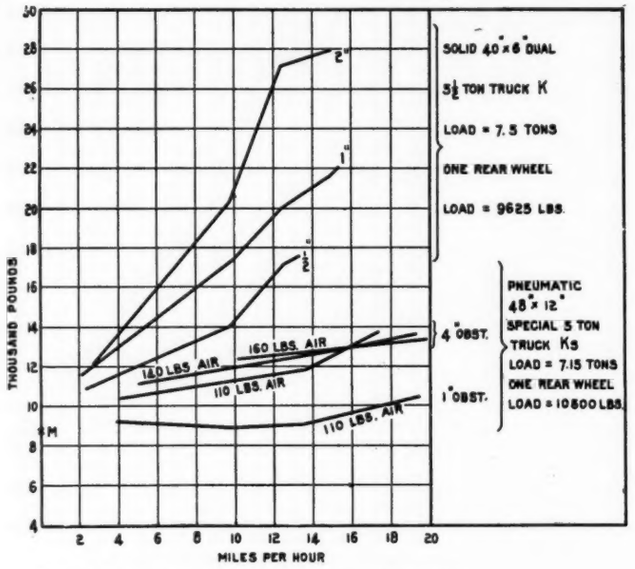


Chart D COMPARISON OF SOLID AND PNEUMATIC TIRES
TWO TRUCKS APPROXIMATELY THE SAME

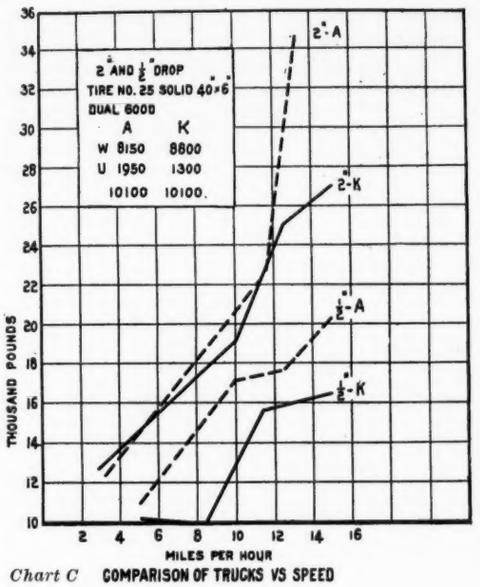


Chart C COMPARISON OF TRUCKS VS SPEED

Fig. 5—Charted results of impact tests conducted at Arlington, Va.

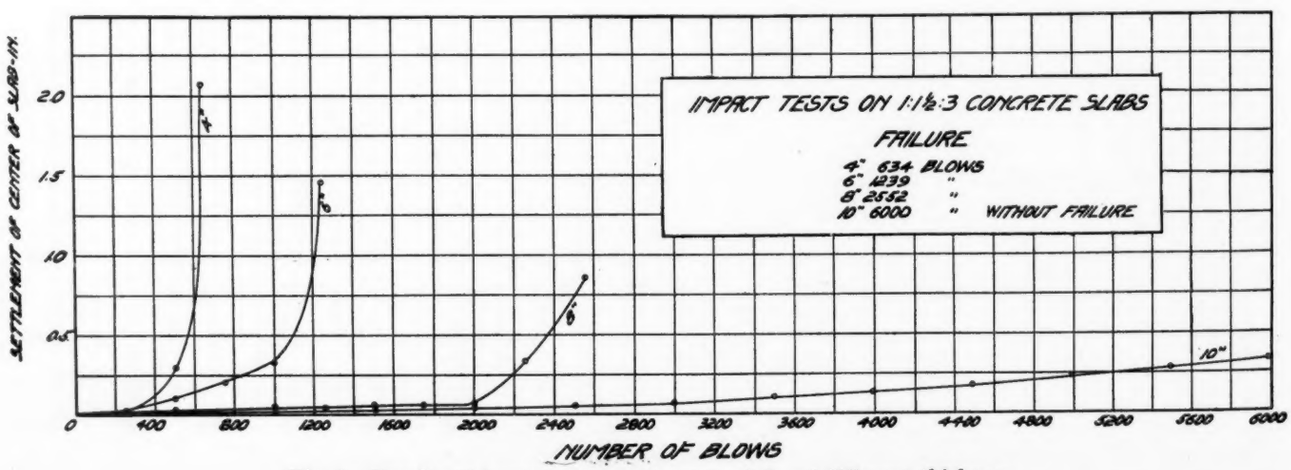


Fig. 8—Results of impact tests on concrete slabs of different thickness

Fig. 6—Apparatus for determining the resistance of road slabs to impact

Fig. 7—General view of construction for impact tests (rapid wear test section to left) on concrete slabs

again the slight dependence of road impact on speed with pneumatic tires is shown.

Tests of Road Slabs

One of the important factors affecting the endurance of roads is the resistance of the road slab to impact. A series of tests were therefore made in which slabs measuring 7 ft. square were laid on subgrades in duplicate, one of the slabs being laid on subgrades purposely rendered wet, and the other on a subgrade which was carefully drained. In these tests the effect of impact by truck wheels was simulated as closely as possible by means of a specially constructed testing machine illustrated in Fig. 6. All specimen slabs were tested to destruction. The apparatus comprises a weight of 1800 lb., which is shod at the bottom with a section of 12-in. solid rubber tire, and carries at the top a 5-ton truck spring on which is supported a weight of 6000 lb. The entire weight is raised and allowed to fall repeatedly on the center of the slab, the height of fall being increased after every 500 blows. At first 500 blows are struck with a drop of ⅛ in., then with a drop of ½ in., then

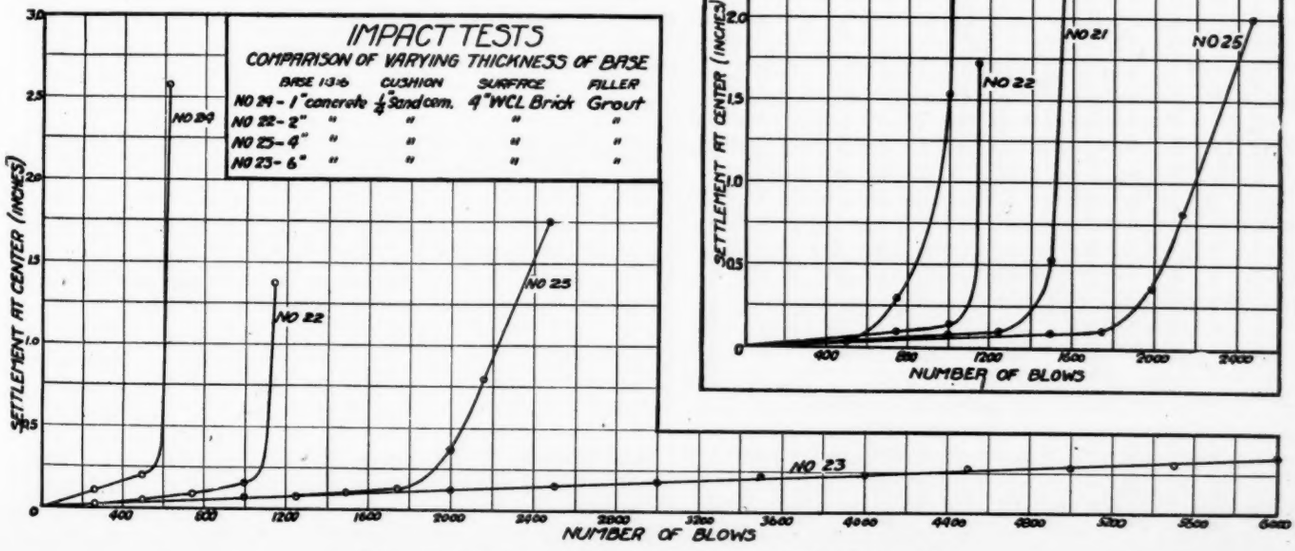

IMPACT TESTS
COMPARISON OF VARYING THICKNESS OF BASE
BASE 1:3:6 CUSHION SURFACE FILLER
NO 24 - 1" concrete ¼" Sand cem. 4" WCL Brick Grout
NO 22 - 2" " " " "
NO 25 - 4" " " " "
NO 23 - 6" " " " "
NO 24
NO 22
NO 25
NO 23
SETTLEMENT AT CENTER (INCHES)
NUMBER OF BLOWS
IMPACT TESTS
COMPARISON OF MONOLITHIC SLABS
BASE 1:3:6 SURFACE CUSHION FILLER
NO 20 - 3" concrete 3" WCL Brick ¼" Sand-cem. Grout
NO 22 - 2" " 4" " " "
NO 21 - 4" " 3" " " "
NO 25 - 4" " 4" " " "
NO 20
NO 21
NO 22
NO 25
SETTLEMENT AT CENTER (INCHES)
NUMBER OF BLOWS

Fig. 9—Results of impact tests on monolithic brick slabs

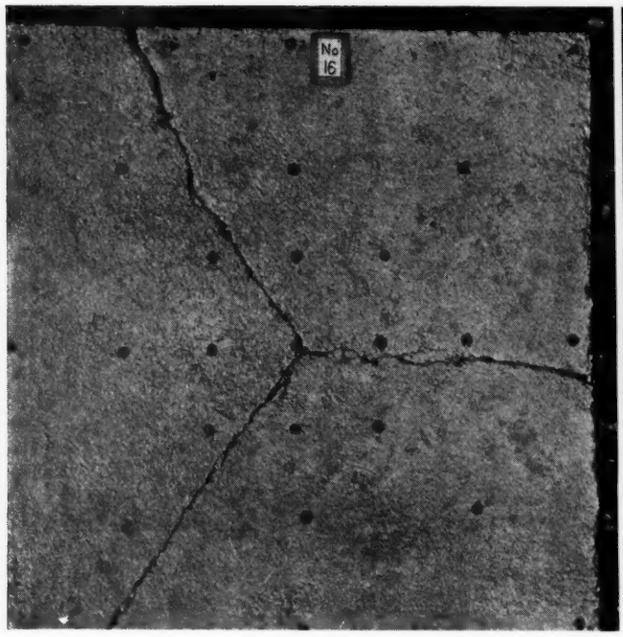


Fig. 10—Section of concrete pavement broken during tests

Fig. 11—Brick section broken during test

with ⅞ in. and so on until a height of drop of 2 in. is reached or the slab is destroyed. In this test the 1800-lb. weight represents the unsprung weight (the truck wheel and axle) and the 6000 lb. the sprung weight of the truck. The pressure exerted by the falling weight upon the slab depends, of course, upon the time in which the weight comes to rest. A general view of the slabs prepared for impact tests is shown in Fig. 7.

In making impact tests it is essential that the specimen be supported in the same way as the road surface is supported in regular service. Service conditions must also be duplicated in respect to weight of falling bodies and range of drop, as any departure from these conditions would give results which it would be difficult to interpret. Fig. 8 shows the influence of the thickness of concrete slabs on their life, as determined by this experimental apparatus. In the tests, all of the slabs were supported on a very poor subgrade. It will be seen that the resistance to impact varies nearly as the square of the depth. It was found that a 4-in. concrete slab has about the same resistance to impact as a 4-in. wire cut slug grouted brick pavement on a 1-in. concrete base. Also, that a 6-in. concrete slab has about the same resistance as a monolithic brick pavement on a 2-in. base. An 8-in. slab has about the same resistance as a 4-in. monolithic brick pavement on a 4-in. concrete base. The deflection curves for a 10-in. concrete slab and monolithic brick on a 6-in. base are quite similar.

Fig. 9 gives the results of comparative tests between monolithic brick pavements, using both 3-in. and 4-in. bricks. In the upper chart are plotted the results of tests with pavements alike in every respect except that the thickness of the concrete base was increased from 1 to 5 in. in three steps. In these charts the number of blows are plotted on the horizontal scale and the settlements at the center of the monolithic slab on the vertical scale. The lower chart represents a comparison of pavements of the same total depth but with varying depths of brick and concrete base respectively, and a comparison of roads with the same depth of concrete base with different thicknesses of brick.

Figs. 10 and 11 show a concrete slab and a monolithic brick slab tested to destruction in the impact test. Tests on tar-sand cushions show less deflection before failure than sections laid on sand. Sand cushion sections have the peculiarity of large settlements before failure. When a pavement is built with a sand cushion, there are two separate slabs, which can move independently one of the other. With a sand cushion the upper slab does not get as firm a support as a monolithic or semi-monolithic construction. A comparison of the sand cushion construction with monolithic and semi-monolithic types shows the monolithic to be stronger that the semi-monolithic and the latter to be stronger than the sand cushion road, the thickness of the base being the same throughout. A 6-in. concrete base proved stronger than a 4-in. base.

Whenever a slab is broken, complete data of the circumstances were noted down. Tests of the subgrade were made with a small impact machine, comprising a 10-lb. steel plunger, having a face area of 10 sq. in. A 10-lb. weight, guided by means of a rod, was allowed to fall on this plunger from a definite height, and the penetration of the plunger under a certain number of blows was noted. This furnishes an arbitrary but convenient method of determining the bearing power of the subgrade. Moisture samples of subgrade were also taken.

(*To be continued*)

English as She's Writ in Continental Europe

From a circular on a new mechanical direction indicator:

The taxi is drawing great drafts on the public's patience and commodity. No wonder that the taxies are being fitted with apparatus that can reduce the friction of the traffic, to common pleasure. The public, the society ought to demand it, and for the owner of the taxi it should be a dear duty. Ships have turning and speed signals, just as much required in darkness as by day. Autopil ought to be found on every motor-car or truck. The millions of mollifications of the nerves that are yearly quoted over the whole world will be reduced by Autopil. Quiet and flegmatically the public can at any time by only looking on Autopil assure it-self about the taxi's intentions and turning-direction.

The Aeronautic Research Laboratory at the Institute of St. Cyr

Facilities for aerodynamic investigations include two sizes of wind tunnels, a whirling arm, and two electrically operated trucks running on rails, all of which are equipped for determining the characteristics of airfoils. One truck is designed for testing propellers.

By John Jay Ide

THE Aerotechnical Institute of St. Cyr, near Versailles, was founded in 1911 by the late Henri Deutsch de la Meurthe, the eminent French patron of aeronautics. It originally formed part of the University of Paris. The first director was Prof. Maurain and his associate was M. Toussaint.

Between 1911 and 1914, in addition to wind-tunnel tests, experiments were made with complete aeroplanes and propellers by means of electric trucks running on a track about a mile long. During the first two years of the war the buildings of the Institute were used as a cantonment for 3000 soldiers of the balloon service. In 1916 the Institute was attached to the Technical Section of Aeronautics and in December, 1917, Major Caquot (then chief of the Technical Section) reorganized it and changed the motive power of the apparatus from steam to electricity. The Institute has now returned to the control of the University of Paris and is under the direction of M. Toussaint.

The equipment for aerodynamical research at the Institute comprises wind tunnels, electric trucks and a whirling arm.

With the three wind tunnels of different sections, complete models of aeroplanes or wings up to one meter span can be tested. The tunnels are also used to determine resistance of streamlined bodies, the working of air-speed indicators, anemometers, etc.

In principle, the object to be tested is subjected to an air stream of known speed and the action of the wind on it is determined by means of a special balance to which the object is attached. This action includes *drag* due to the relative wind acting on the object and, in the case of oblique surfaces, the vertical component or lift.

Description of Wind Tunnels

The large wind tunnel (Fig. 3) is 119.8 ft. in total length and 13.1 ft. in diameter at the propeller end. The range of speeds is between 16 and 147 ft. per second. The tunnel consists of:

1. An intake trumpet which collects in the entrance to the test chamber sufficient air for the air stream. At the time of my visit there was under construction a honeycomb of 8-inch squares to be fitted in the mouth of the trumpet to eliminate turbulence. This honeycomb was to replace the one at that time in use placed at the entrance to the test chamber, as is the customary practice.
2. The test chamber, 6.6 ft. in diameter and 19.7 ft. long.
3. The diffuser, a diverging cone prolonged by a wood lattice cylinder 31.2 ft. long.
4. The six-bladed screw. An electric motor of 120 hp. operates the screw which sucks the air from the room into the intake trumpet. The air stream reaches its maximum speed in the reduced section of the test chamber where the pressure is below that of the outside air. At the exit of the test chamber the air passes into the diffuser, which brings the pressure back to normal.

In the center of the test chamber is the movable arm (*B*) (see diagram) of the aerodynamic balance protected from the wind by a casing. The model to be tested is attached to the end of the beam in the center of the tunnel.

The balance is composed of two systems of joined parallelograms interconnected but independent as to the measurement of horizontal and vertical forces to which the model is subjected. The balance is carried by a truck with four rollers permitting easy displacement on two rails perpendicular to the axis of the tunnel and four jackscrews to raise the truck on the rails and to clamp it in desired position. This balance is shown in Figs. 1 and 5.

The vertical support carrying the bearing points of the mobile system is attached to the cars. This system is composed of a series of steel levers of cross-shaped tubular section. The joints of the different lever arms are provided with ball bearings.

The Aerodynamic Balance

The intermediate cross arms of aluminum form a rigid connection between the two systems of parallelograms. The carbon steel cross beam of T section is attached to the vertical rod, of which the thin arm carrying the model is a prolongation. The model is attached to the arm by adjustable rods.

The case (*A*), Fig. 5, inclosing the vertical rod is bolted to a plate arranged to close the tunnel completely between the two doors. Four vertical bars attach the head directly to the truck so that the balance, plate and case comprise an assembly that can be moved at will.

An arrangement with a mercury joint, while permitting freedom of movement, renders the passage of the bar through the plate airtight, while the depression inside the tunnel translated into a downward vertical force is neutralized. Finally there are provided gages registering simultaneously the forces of lift and drag.

Aerodynamic experiments with the wind tunnel are made in the following manner:

Once the model is adjusted to a predetermined angle to the horizontal and the needles of the lift and drag indicators (*K*) and (*K'*) set at zero, the air stream is given the desired speed which the observer reads on an alcohol manometer connected to the test chamber. Weights placed on the scale pans (*C*), (*D*) balance the lift and drag forces so that the measurements are made simultaneously.

The small wind tunnel is distinguished from the large

one by the various diameters 0.66, 0.98 and 1.31 ft. of the test chamber which can be obtained. An electric motor of 20 hp. operates the centrifugal suction pump, which gives to the air stream speeds varying from 65 to 278 ft. per second. This small tunnel is intended particularly for experiments on the resistance of bodies of small diameters in high-speed air currents. Coefficients of similitude have also been determined for different scales by testing various shapes of streamlined hulls in the small tunnel and comparing the results with those obtained by testing similar bodies in the large tunnel. The small tunnel is likewise used for calibrating speed indicators, Pitot tubes, anemometers and other aeroplane instruments.

The wind tunnel of Captain Lelarge originally at Chalais-Meudon and later removed to St. Cyr differ in principle from the tunnels described above. It is of the single duct continuous circuit type. It has an effective section of 4.9 x 8.2 ft. and the air stream varies in speed from 13 to 65 ft. per second.

There are two electric trucks designed to run at high speed along a track 0.9 mile long. One of them (Fig. 2), for testing full size wings and airplanes, is in reality an aerodynamic balance moving through still air; it measures forces comparable to those measured in a wind tunnel.

The truck has a 120 hp. electric motor mounted on a platform and carries a superstructure forming an aerodynamic balance to which is attached the aeroplane or wing section to be tested. The tubes carrying the test section compose the superstructure; these tubes are carried at the end of four vertical struts jointed with the superstructure at their upper ends. The struts, movable about an axis perpendicular to the direction of motion of the truck, form a jointed parallelogram deformable under the action of the forces of head resistance. On the other hand, a system of horizontal levers themselves jointed at the points of the fixed framework of the truck support the struts and permit them to be displaced parallel to themselves in the vertical direction under the action of the forces of lift.

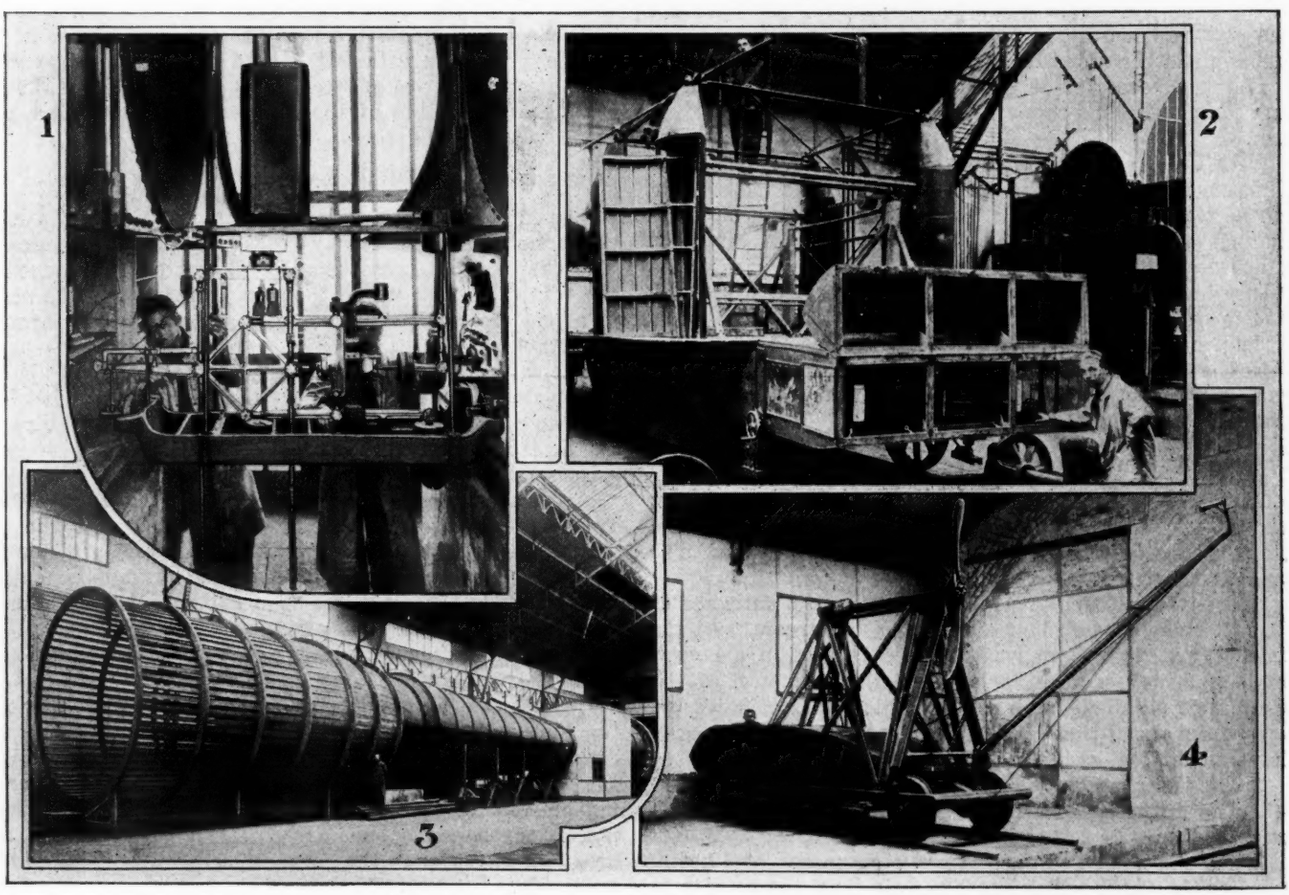
Counterweights balance the system as to inertia and force of gravity, while dynamometers measure the forces of drag and lift which the speed of the truck with reference to the air registers by means of an anemometer calibrated in calm weather.

For testing, the truck is sent over the track at speeds between 0 and 55 miles per hour. The recording instruments show the values of lift and drag on the surface as well as speeds relative to the ground or air. Care is taken to experiment in calm weather although a wind vane gives the component of the relative wind which is taken into account in the calculations.

An electric current scores a reference mark at the right moment on the record of each instrument and thus facilitates taking all the measurements simultaneously. Comparative wing tests between the truck and the large wind tunnel show that the two methods are in substantial agreement.

The truck for propeller testing (Fig. 4) differs from the truck just described in that it is driven by the propellor under test. An 80 h.p. motor drives the propeller through two bevel gears at speeds between 0 and 50 miles per hour.

The vertical shaft connected to the universal joint between the two transmission cases can be displaced parallel to its axis. The shaft is partially held in place forward by a ball thrust bearing at the top of the frame jointed at the base. The shaft is supported by a plain bearing.



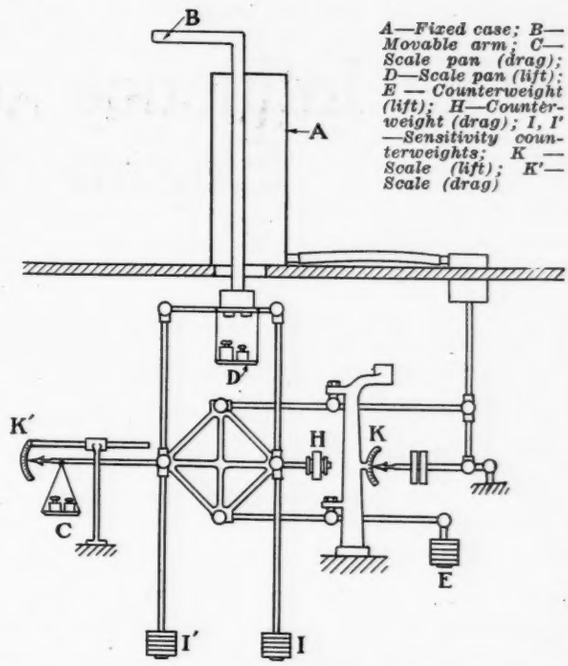
Aerodynamic testing equipment owned by the Aeronautic Institute Laboratory at St. Cyr, France

Under the action of the pull of the propeller the horizontal shaft tends to move forward, taking with it the top of the frame. This movement is checked and recorded by dynamometers. The forward speed is measured by means of a tachometer giving the speed of rotation of the back axle and it is checked by an anemometer giving directly the speed of the truck with reference to the air. The speed of revolution of the propeller is read on a tachometer giving the revolutions per minute of the motor. Watt meters indicate the power delivered and absorbed by the screw.

From the information furnished by the various recording instruments which includes the traction of the propeller, revolutions per minute, absolute ground speed, relative speed with respect to the air, power delivered and absorbed, the efficiency curves of each type of propeller can be drawn.

With the whirling arm the same tests can be made as with the wind tunnels, the objects to be tested being moved through the air. Difficulties in connection with neutralizing centrifugal forces have resulted in discontinuing experiments with the whirling arm at the present time.

In addition to the apparatus described above the Institute possesses physical and chemical laboratories, a low pressure air chamber used for physiological tests and machine shops for metal and woodworking and for making models.



A—Fixed case; B—Movable arm; C—Scale pan (drag); D—Scale pan (lift); E — Counterweight (lift); H—Counterweight (drag); I, I'—Sensitivity counterweights; K — Scale (lift); K'—Scale (drag)

Fig. 5—Diagram of aerodynamic balance used at St. Cyr

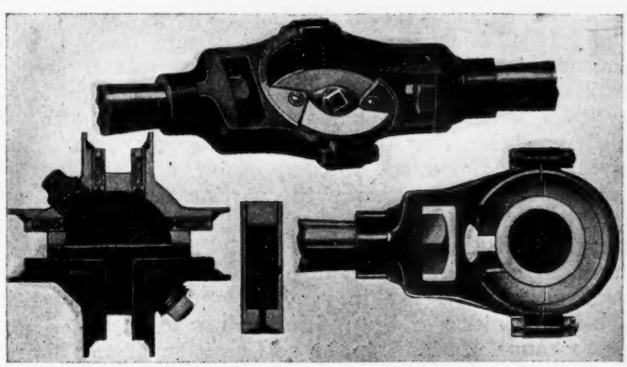
A Self Lubricating Universal Joint

A METAL universal joint containing a large lubricant reservoir, having large bearing surfaces and permitting of great angularity between shafts, has been developed by the Noyes-Richards Engineering Co. As will be seen by the cut it is somewhat similar to the type of universal joint used on machine tools, as the central member connecting the two forks is of spherical form and is provided with two circumferential grooves at right angles to each other in which the forks of the joint engage. The two forks are arranged at right angles, as usual, and are secured to their shafts by a taper joint with key and nut. Each fork is provided with a cap which has a stepped joint with the fork and is held in place by two cap screws.

The central, spherical portion is a hollow bronze casting and has two holes closed with pipe plugs, through which the lubricant can be introduced. These plugs are located on opposite sides of the ball, and one or the other will always be in an accessible position. Adjacent to the grooves in the ball into which the fork rings fit there are lubricant cartridges. These cartridges are embedded in the flanges of the ball, which between them form the grooves for the fork rings. Each cartridge has a lubricant inlet opening to the lubricant chamber in the ball. The cartridge is bored out and is filled with compressed felt, which is saturated with lubricant. The felt is compressed by forcing a plug into the end of the cartridge. At the side of the cartridge there is an outlet through which the lubricant reaches the bearing surface.

The fork ring is formed with an internal flange which fits into the groove on the bronze ball. The web or backbone of the fork ring fits into a widened portion of the groove on the bronze ball and its inner corners are chamfered so as to make room for triangular leather packings in the groove at both sides of the ring. Metal dust clips lined with leather washers can be secured to the bronze ball so as to exclude dust from the joint.

It is claimed for this joint that it has more bearing surface and more angularity and is much lighter than a pin joint built to transmit the same power. We understand that this joint has been thoroughly tested out and that its freedom from oil-throwing has been demonstrated.



A new all-metal universal joint with reservoir for lubricant

Carbureter Tests for Fuel Economy

THE fuel economy of motor cars, which can be affected by adjustments of the carbureter, has recently been demonstrated by the Royal Automobile Club. Tests made at Brooklands on six different makes of car showed that by merely changing to smaller carbureter jets an average increase of mileage of 22 per cent. was obtained. The average loss in maximum speed was only two miles per hour, and the average extra time taken to climb the test hill was only 1 4-5 seconds. It is proposed to organize a competition on lines similar to those of the tests, for which some prizes are being offered by a motor car paper.

The Influence of Various Fuels on Engine Performance

Part II

In this instalment of the report upon the investigation of fuels, detonation and the effect thereon of combustion chamber design, turbulence, speed of rotation, temperature and pressure are discussed at length, and measurements of the value of a fuel in terms of its tendency to detonate are tabulated and plotted in their relation to other important factors.

By H. R. Ricardo*

PREVIOUS experience had indicated very clearly not only that the tendency of fuels to detonate was probably by far the most important of the factors controlling the power output and efficiency of an internal combustion engine of the explosion type, but also that the tendency to detonate varied widely as between different fuels, and was likely to prove much the most important factor in determining their suitability or otherwise for use in an internal combustion engine. This has proved to be the case. It was, of course, common knowledge that certain brands of gasoline detonated more readily than others, that commercial benzol would not detonate under any circumstances in an engine of normal design, and that the addition of benzol to gasoline always reduced its tendency to detonate. Beyond this little was definitely known. It was decided, therefore, to make as thorough an investigation as possible into the whole phenomenon of detonation.

Before dealing with the influence of the nature of the fuel upon detonation it will be well to consider first the influence of detonation itself upon the performance of an engine.

All engines using volatile liquid fuels operate on a cycle in which a combustible mixture of fuel and air is drawn into the cylinder, is compressed, ignited and then expanded until it occupies the same volume as before compression. From any given weight of mixture, the power output and efficiency obtainable depend upon the degree of expansion, and since, in this cycle, the ratio of compression and expansion are equal, it follows that both power and efficiency are dependent upon the ratio of compression. Setting aside for the time being such questions as dissociation at high temperatures, change of specific heat and loss of heat to the cylinder walls, all of which reduce the absolute efficiency obtainable, but which do not alter materially the relationship between compression ratio and efficiency, we find that the limiting theoretical efficiency is as given by the formula

$$E = 1 - \left(\frac{1}{r}\right)^{\gamma - 1}$$

where r = the compression ratio and γ the ratio between the specific heat of air at constant pressure and at constant volume.

Fig. 1 shows the relationship between efficiency and compression over the range from 3.5:1 up to 7.5:1 according to this formula, which is known as the air standard of efficiency, and is the accepted basis of comparison.

It will be observed that the air standard efficiency rises rapidly at first as the compression ratio is increased, but the gain in efficiency diminishes considerably with the higher compression ratios. It is doubtful whether, but for exceptional cases, any material advantage would be obtained from the use of a compression ratio higher than 7:1, on account of the relatively small gain in efficiency obtainable thereby, and the very high maximum pressures involved. To withstand these high pressures would necessitate a considerable increase in the cost and weight of the engine, and an increase also in the internal friction due to the heavier reciprocating and rotating parts.

The compression ratio which can actually be employed is governed in practice by the tendency of the working fluid to detonate under the high pressure and temperature of compression.

The phenomenon of detonation appears to be substantially as follows. When a mixture of hydrocarbon vapor and air is compressed to a high pressure and to a temperature approaching that of its self-ignition temperature and then ignited from any one point, the flame at first spreads by the normal process of combustion, compressing before it the unburnt portion of the charge. When the rise in temperature of the unburnt portion due to compression by the burning gases exceeds the rate of heat dissipation by a certain margin, spontaneous ignition of the former takes place, and an explosion wave is set up which strikes the walls of the cylinder with a hammerlike blow, thus causing the familiar metallic ring known as "pinking" or "detonation." It also has the effect of compressing and still further raising the temperature of the portion first ignited, and with it the temperature of the ignition plugs or other partially insulated objects in their immediate vicinity. If detonation be allowed to persist it will, unless it be very slight, increase in severity and ultimately raise the temperature of the igniter points to such a degree as to cause pre-ignition, or self-ignition of the charge, during compression and before the spark has passed; this is quite a distinct phenomenon and must not be confused with detonation.

*From a preliminary report on extensive research work conducted by the author and other prominent British investigators for the Asiatic Petroleum Co. and published in *The Automobile Engineer*.

It will be seen that detonation depends upon the normal rate of burning of the fuel, and occurs only when the rate of spread of flame is appreciably greater than the rate at which the unburnt portion can get rid of its heat. It is dependent also to a lesser degree upon a number of other factors which will be considered shortly.

Before proceeding further, it is well to point out that there are several stages of detonation, depending upon how far the normal spread of combustion has extended throughout the mass of the working fluid before spontaneous ignition occurs. Detonation, in its incipient stages, is sometimes very difficult to detect, because it is often unaccompanied by any audible noise, but rather by what may be termed harsh running.

The following very interesting and instructive experiment was frequently carried out:

A fuel was selected which, in the variable compression engine, was known to detonate with a compression ratio of say 5:1. The compression was set at, say, 4:1, and the engine run wide open at a constant speed. The compression was then gradually increased, and the general running and behavior of the engine carefully watched. As the compression rose gradually from 4 to about 4.7:1, the power output would rise also, approximately in proportion to the air-cycle efficiency, and the running of the engine generally would be smooth and silent, with very little vibration. Between 4.7 and 4.8:1 the running would become slightly harsher; from 4.8 to 4.9:1 there would be a very noticeable increase in harshness, accompanied by a considerably greater volume of noise and a marked increase in vibration, while at 5:1 the first audible signs of detonation would be detected, though they would be apparent only when ignition was fully advanced and the mixture strength also was adjusted to give maximum possible power.

With a compression ratio of 5:1 the engine would continue to run developing maximum power for an indefinite period, but pinking slightly all the time. If the compression ratio were further raised to about 5.1:1 and the ignition and mixture settings unaltered, detonation would increase in severity until, after about 5 or 10 minutes, pre-ignition would set in, and the power would fall off. If, however, the mixture strength were increased to give a slower burning mixture or the ignition timing retarded, the compression could be raised considerably higher, even to as high as 5.25:1 without any perceptible detonation. The same result could also be obtained by reducing the mixture strength, though freedom from detonation would become apparent only when the strength was so far reduced as to leave very little range. The total available range of mixture strength on the weak side is very narrow in the case of all volatile hydrocarbon fuels, so narrow indeed that to attempt to escape detonation by working entirely on the weak side would be completely out of the question in any practical multicylinder engine on account of irregularities in distribution. That it is possible to defer detonation by working between these very narrow limits is only what one would be led to expect from a consideration of the factors controlling detonation. This condition can readily be demonstrated as a laboratory experiment on a single-cylinder engine equipped with very delicate adjustments, and is interesting from a scientific point of view, but it can hardly be considered to be applicable in practice.

So far as practical considerations are concerned the rate of burning can be réduced, and at the same time stable conditions of running can be maintained, only by working on the rich side of the range. Under these conditions, however, the power output and economy cease to rise with increase of compression because the time of ignition or the mixture strength is no longer the most favorable. By further enriching the mixture and retarding the ignition, the compression can be increased to as high as 5.4:1, but, of course, only at great sacrifice of economy. The m.e.p. and thermal efficiency curves obtained from such a test are shown in Fig. 2.

It will be observed that, although the first indications of detonation occurred with a compression ratio of about 4.75:1, it is possible by suitable adjustments of the mixture strength and ignition timing to raise the compression to as high as 5.4:1 without allowing the detonation to become so severe as to set up preignition. **Although the precise compression at which detonation becomes serious varies with different mixture strengths or ignition timing, the compression at which it develops with the most efficient mixture strength and ignition timing is quite clearly defined, and that to within very narrow limits.** This point, namely, the compression at which detonation first becomes audible with certain definite temperature conditions and with both the ignition and mixture strength adjusted to give the highest efficiency, is taken hereafter as representing the highest useful compression ratio for any fuel. It is not the highest compression which can be employed, but the highest that it is worth while to employ.

It is necessary to emphasize this definition because it has a very important bearing upon what follows, and largely explains why certain fuels or mixtures of fuels appear to give more power and increased efficiency than others in the same engine.

The explanation of this is evident enough. Most engines have already too high a compression to enable them to run efficiently on many or even most of the brands of gasoline now on the market, with the result that they have to operate with the ignition too far retarded, and the mixture too rich. On changing over to another fuel having a higher detonation point, it at once becomes possible to advance the ignition timing and correct the mixture strength, with an immediate gain both in power and economy. Had the same two brands of gasoline

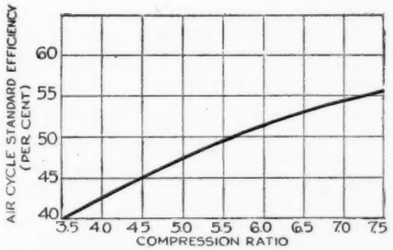


Fig. 1—Relation between the air cycle standard efficiency and compression ratio. (Total volume ÷ clearance volume)

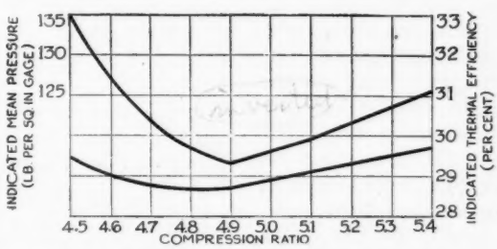


Fig. 2—Variation in mean effective pressure and thermal efficiency with different compression ratios for a fuel detonating normally at a compression of 5.0:1

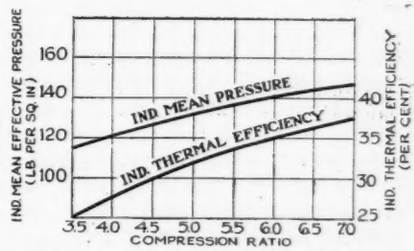


Fig. 3—Variation in indicated m.e p. and indicated thermal efficiency with different compression ratios for a fuel not detonating below a ratio of 7:1 (say for toluene) in the variable compression engine

been tried in an engine with a lower compression ratio no perceptible difference in power or efficiency would have been observed. **It will be shown later that when various fuels are compared at a compression ratio low enough to permit of the most efficient mixture strength and ignition timing being used in each case, the efficiency is substantially the same on all fuels. Likewise it will be shown that so long as the liquid fuel is completely evaporated before its entry to the cylinder, the power output also is substantially the same for any fuel.**

Before dealing with the effect of the composition of the fuel upon its tendency to detonate it will be well to consider first certain other factors which influence detonation.

Factors Which Influence Detonation

(1) The design of the combustion chamber and the position of the ignition plug have a very important influence. **The more compact the combustion chamber, and the more central the position of the igniter, the less will be the tendency to detonate.** For it is clear that with a compact combustion chamber there is less danger of any unburnt portion of the gas becoming stagnant and therefore unable to give up its heat at a greater rate than it is generated by compression due to the burning portion of the working fluid. Again, it is clear that the ignition plug should be as nearly as possible in the center of the combustion space, in order to reduce as far as possible the distance the flame has to travel. With the exception of sleeve-valve engines, it is usually impracticable to place the ignition plug in the center of the combustion space, and the question therefore arises as to the best position for it. **Consideration will show that if the gases must be ignited from one side of the combustion chamber, the ignition plug should be placed on the hottest side, that is to say, on the side nearest the exhaust valve, so that the unburnt gases are compressed against the coolest surfaces, and can therefore get rid of their heat the more rapidly. When the ignition plug cannot be fitted centrally in the head it is clearly preferable to provide two plugs at opposite sides so that the spread of flame takes place from two opposite points and has only about half the distance to travel. The use of two plugs is, however, of little value unless the time of passage of the spark across both is perfectly synchronized.**

(2) **Turbulence.**—The greater the degree of turbulence within the combustion chamber the better, since turbulence tends to spread and distribute the flame uniformly throughout the working fluid and so reduces the danger of portions of it being entrapped and detonated. **From the point of view of detonation the worst possible condition is reached when the exhaust valve is fitted in a side pocket in which the mixture may become more or less stagnant, and the igniter fitted at the opposite side of the combustion chamber.** In such a design (and it is not an uncommon one) a portion of the working fluid will be entrapped in a position ideal for detonation where the bulk of the surface to which it can impart its heat is made up of a hot exhaust valve head and, generally, an uncooled plug for the removal of the valve. Under these conditions, detonation will occur very readily, but it may not so readily develop into pre-ignition, because the sparking plug may have very good facilities for getting rid of its heat, and the points are not so readily overheated by the return wave.

(3) **Speed of rotation.**—It is, of course, common knowledge that the tendency to detonate varies with the speed of rotation, and indeed this is only what might be expected, for the lower the speed, the lower the turbulence. As the speed is reduced not only is the velocity of entrance reduced in the same proportion, but the time during which turbulence may die down is correspondingly prolonged. Again, although the mean temperature of the working fluid at the end of the compression is, no doubt, somewhat lower at low speeds, yet the temperature of the surface of the combustion chamber necessarily varies considerably, and this, coupled with the lack of turbulence, results in the formation of local zones of gas, in the neighborhood of the exhaust valve for example, of much higher temperature than the average, and which may in fact attain a temperature approaching very nearly to the self-ignition temperature of the fuel. The existence of these hot zones coupled with a condition of general stagnation naturally predisposes the very conditions favorable to the development of detonation.

(4) **Effect of temperature** upon detonation. Since detonation is brought about by the compression of some portion of the working fluid to a temperature in excess of its self-ignition temperature, it follows that **for any given normal rate of burning, the higher the temperature of the working fluid the greater will be its tendency to detonate,** since the rise of temperature required to produce spontaneous combustion is correspondingly less.

(5) **Effect of pressure** upon detonation. Apart from the composition of the fuel, **the pressure of compression appears to be by far the most important factor controlling detonation.** It appears that the normal rate of flame propagation prior to the formation of an explosion wave bears some direct relation to the pressure of the gases, the explanation presumably being that under high pressure the fuel and air are in more intimate contact, and therefore each particle of fuel can the more readily find the oxygen necessary for its combustion. It will be shown later that the pressure of compression was found to play relatively a considerably more important part than the temperature of the gases at the end of the compression.

Use of Supercharging Engine

For the investigations into the relationship between the composition of the fuel and the tendency to detonation both the research engines referred to previously were employed. In this connection the supercharging engine working with a stratified charge proved particularly valuable. This engine was, for the purpose of these tests, fitted with a piston giving a normal compression ratio of 5.18:1, corresponding to a compression pressure of 116 lb. per sq. in. gage. When desired, additional air, compressed below the piston, could be admitted to the cylinder after the completion of the suction stroke through ports cut near the bottom of the cylinder barrel, thus raising the compression pressure to approximately 155 lb. per sq. in. Before entering the cylinders, the air —compressed to a pressure of 9 lb. per sq. in.—is forced to pass through an intercooler by means of which it is cooled to a temperature approximating that of the cylinder contents. It will be seen, therefore, that when the supercharge is admitted by opening the ports in the cylinder wall, the pressure of compression is raised by approximately 35 per cent, but, since the ratio of compression is unaltered, the temperature is unchanged. By this means, therefore, it became possible to raise the compression pressure without raising appreciably its temperature.

By admitting the air supercharge through ports near the bottom of the cylinder and by suitable formation of the ports and the head of the piston, it was found possible so to separate the active working fluid and the air that they did not completely mix during the compression stroke, and by this means the presence of a considerable excess of air over that required for complete com-

bustion could always be assured, thus permitting what is not obtainable in an ordinary engine, namely, a very wide range of mixture strength over which combustion was complete. In the supercharging engine, therefore, two variables, always present in any normal type of engine, were almost eliminated, namely, the temperature of compression and the mixture strength. Thanks to the absence of these two variable factors it was found possible to arrive at the detonation point of any fuel not only very quickly but also with a very high degree of accuracy.

To attempt to analyze fully the process of combustion in such an engine is beyond the scope of this report, but it is sufficient to state that this method afforded a means of comparing the detonation points of various fuels under strictly comparable conditions, with great readiness and fair precision. It is, however, open to the obvious objection that it does not afford any means of expressing the detonation point in terms of compression ratio, which, of course, is the practical issue; this deficiency was, however, met by means of check tests in the variable compression engine.

Use of Variable Compression Engine

In the case of the variable compression engine, the actual compression ratio at which detonation first became apparent could be found by gradually raising the compression. Since, however, the tendency to detonate depends largely upon the mixture strength, it was always necessary to insure, by making fuel consumption tests, that the correct mixture had been found, and in view of the fact that for every fuel tested a different carbureter adjustment had to be found, it will readily be realized that the detonation point could not be determined so quickly or with quite such precision as in the supercharging engine. Also in the variable compression engine, probably owing to its more rigid construction, detonation was less easily detected.

The procedure adopted in nearly every case was first to test each fuel against the standard fuel in the supercharging engine, and so determine its detonation point in relation to that of the standard, the detonation point as found on this engine being expressed in terms of the indicated mean pressure at which detonation became apparent. The same samples were then tested in the variable compression engine and a definite relationship established between the mean pressure at which detonation occurred in the supercharging engine, and the corresponding compression ratio in the variable compression engine. With one or two notable exceptions the results tallied reasonably closely, so that once the relative detonation point of any fuel had been determined in the supercharging engine, the highest useful compression ratio for that fuel could be predicted fairly closely. There were, however, one or two exceptions to this rule, and in the case of these exceptions it must be assumed that the relative influence of temperature and pressure upon the tendency to detonate differed from that of the majority.

In view of the influence both of speed of rotation and of temperature upon the tendency to detonate, great care was taken to insure that the same temperature conditions prevailed in both engines and that the speed of rotation was always the same.

In all, many hundreds of tests of the nature described above were carried out. Not only were samples of practically all the brands of commercial gasoline and benzol tested, but also nearly pure samples of several members of each of the series comprised in gasoline, including various sulphur compounds, also alcohol, acetone, acetylene, ether, etc., were investigated.

Effect of Fuel on Detonation

In the case of ethyl-alcohol, acetone, toluene and xylene, it was found quite impossible to induce detonation under any circumstances in either engine. The relative detonation point, however, of these fuels could be determined by preparing mixtures of each of them with the standard aromatic free gasoline or with hexane. It was found that, in all cases, the detonation point of such mixtures followed a straight line law when the mixture was apportioned by weight and not by volume: that is to say, the addition of 40 per cent by weight of, say, toluene to hexane would raise the detonation point exactly four times as much as the addition of 10 per cent. One interesting point was repeatedly observed. When benzol and certain other fuels also were tested alone in the variable compression engine and attempts made to induce detonation by raising the compression, occasional pre-ignition would occur when the compression ratio exceeded 7:1 these pre-ignitions being denoted by a dull thud and an immediate drop in speed and power. It would appear, therefore, that such fuels when used pure, pre-ignite without preliminary detonation, but the addition of a comparatively small proportion of paraffins would induce preliminary detonation at high compression ratios. The same applies also to the naphthenes, methyl alcohol, methylated spirits and one or two others.

Table III gives the detonation point as found in both the variable compression and supercharging engines.

In Fig. 3 is shown the variation in mean pressure and efficiency with compression ratio as found by actual experiments on the variable compression engine. These curves represent the mean of a great number of tests carried out on a large number of different fuels, and

Table III—Effect of Compression on Detonation

	A	B	C	D
		In Variable Compression Engine. Compression at Which Detonation Occurred with Most Economical Mixture and Ignition Timing		In Supercharging Engine Ind. Mean Pressure at Which Detonation Occurred
Fuel	Specific Gravity at 15° C. (59° F.)	Comp. Ratio	Comp. Pressure Lbs. per Sq. In. (Gage)	Lbs. per Sq. In. (Gage)
Aromatic free gasoline.	0.718	4.85	105.5	120.0
"A" gasoline	0.782	6.0	148.5	144.0
"B" gasoline	0.723	5.7	133.5	133.0
"C" gasoline	0.727	5.25	118.0	129.0
"D" gasoline	0.760	5.35	121.5	129.5
"E" gasoline	0.719	4.7	100.5	117.0
"F" gasoline	0.704	5.05	111.5	125.0
"G" gasoline	0.750	4.55	96.0	115.0
"H" gasoline	0.767	5.9	140.5	137.0
Heavy aromatics	0.885	6.5	163.5	....
Kerosene	0.813	4.2	86.0	....
Paraffin Series				
Hexane, 80%	0.685	5.1	113.5	124.5
Heptane (pure)	0.691	3.75	72.0	....
Aromatic Series				
Benzol, 98%	0.884	6.9*	179.0*	ND
Toluene, 99%	0.870	>7.0	>183.0	ND
Xylene, 91%	0.862	>7.0	>183.0	ND
Naphthene Series				
Cyclohexane, 90%.....	0.786	5.9*	140.5*	148.0
Hexahydrotoluene, 78%	0.780	5.8	136.5	140.0
Hexahydroxylene, 60%	0.744	4.9	107.0	121.5
Olefine Series				
Cracked spirit, 53%...	0.757	5.55	128.0	....
Alcohol Group				
Ethyl alcohol, 98%...	0.798	>7.5	>204.0	ND
Methyl alcohol (purified wood naphtha)	0.829	5.2*	116.5*	....
Methylated spirits....	0.821	6.5*	163.5*	....
Acetone	0.798	>7.0	>183.0	ND
Ether	0.735	(2.95)	(47.5)	....
Miscellaneous				
Carbon disulph.	1.270	(5.4)	(123.0)	(134.0)

Notes.—* Denotes that the value given for compression could not be exceeded owing to preignition occurring before audible detonation.
( ) Where values are given in parentheses they are arrived at by extrapolation of the curves obtained from tests made with mixtures of these fuels with aromatic free gasoline.
ND Signifies that there was no detonation up to the limit of pressure obtainable in the supercharging engine.

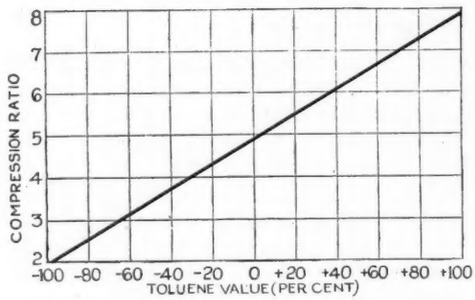


Fig. 4—Relation between toluene value and compression ratio in the variable compression engine

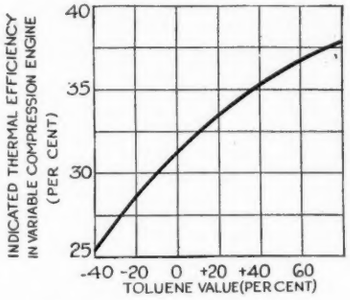


Fig. 5—Relation between toluene value and indicated thermal efficiency in variable compression engine

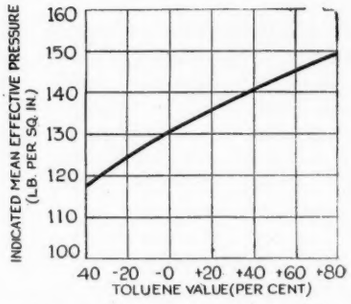


Fig. 6—Relation between toluene value and indicated mean effective pressure in variable compression engine

since in no case did the results vary by more than 1 per cent, the accuracy of the mean result may be accepted as being of a high order. It is very important to note that the relationship between power output (expressed in terms of indicated mean pressure), and of economy (expressed in terms of indicated thermal efficiency), and compression ratio was found to be the same for all fuels. Examination of these results will reveal that the inter-relationship between power output and thermal efficiency varies at different compressions. This can be partially, but not, in the writer's opinion, wholly, explained by certain investigations which will be dealt with later on.

In Table IV are given the efficiency and power output obtainable from many different relatively pure samples, and a number also of composite fuels, comprising representative samples of most of the brands of gasoline now on the market. As already explained, it is improbable if it will ever be worth while to employ a compression ratio in excess of 7:1, and the efficiency corresponding to this compression ratio has been taken as 100. It is well to bear in mind, however, that toluene, xylene, alcohol and one or two others will, in fact, withstand a considerably higher compression without detonation. **Prior to the investigations on ethyl alcohol, and the members of its group, the highest detonation point observed was that of toluene, and it was therefore decided, for the sake of conve-**

Table IV—Relative Merit of Various Fuels in Respect to Power and Thermal Efficiency

Fuel	A Specific Gravity at 15° C. (59° F.)	B Highest Useful Compression Ratio. Total Volume / Clearance Volume	C Ind. Thermal Efficiency at Highest Useful Compression. Per Cent	D Relative Thermal Efficiency (Efficiency of 37.5% at Compression Ratio of 7:1 Is Taken as = 100). Per Cent	E Ind. Mean Pressure at Highest Useful Compression with Heat Input to Carbureter of 65 B.t.u.'s per Min. Lbs. per Sq. In. Gage	F Relative Ind. M.E.P. (the I.M.E.P. of 147 Lbs. per Sq. In. Obtained with Toluene at 7:1 Compression Is Taken as = 100). Per Cent
Aromatic free gasoline	0.718	4.85	31.4	83.7	130.0	88.4
"A" gasoline	0.782	6.0	34.9	93.0	140.1	95.3
"B" gasoline	0.723	5.7	34.1	91.0	137.5	93.5
"C" gasoline	0.727	5.25	32.5	86.7	133.9	91.0
"D" gasoline	0.760	5.35	33.1	88.3	134.9	91.7
"E" gasoline	0.719	4.7	30.7	81.8	128.6	87.5
"F" gasoline	0.704	5.05	32.1	85.6	132.7	90.2
"G" gasoline	0.750	4.55	30.2	80.5	127.4	86.6
"H" gasoline	0.767	5.9	34.6	92.2	139.5	94.8
Heavy aromatics	0.885	6.5	...	...	142.5	96.9
Kerosene	0.813	4.2	...	...	123.0	83.6
Paraffin Series						
Hexane, 80%	0.685	5.1	32.4	86.4	133.1	90.5
Heptane (pure)	0.691	3.75	26.7	71.2	119.0	81.0
Aromatics Series						
Benzol, 98%	0.884	6.9	37.2	99.2	146.5	99.6
Toluene, 99%	0.870	7.0	37.5	100.0	147.0	100.0
Xylene, 91%	0.862	7.0	37.3	99.5	146.8	99.9
Naphthene Series						
Cyclohexane	0.786	5.9	34.9	93.0	139.2	94.6
Hexahydrotoluene	0.780	5.8	34.3	91.5	137.9	93.7
Hexahydroxylene	0.744	4.9*	31.5	84.0	130.0	88.4
Olefine Series						
Cracked spirit, 53%	0.757	5.55	33.9	90.4	136.0	92.5
Alcohol Group						
Ethyl alcohol, 98%	0.798	7.5	40.4	107.9	156.5	106.4
Methyl alcohol (purified wood naphtha)	0.829	5.2	35.0 approx.	93.3	146.6	99.6
Methylated spirits	0.821	6.5	38.5 approx.	102.7	155.5	105.8
Ether	0.735	(2.95)	(19.5)	52.0	(116.5)	79.2

Notes.—* The sample of hexahydroxylene was very impure, namely, not more than 60 per cent.

( ) The values for ether are deduced from tests made with a mixture containing 50 per cent by volume of ether and 50 per cent of aromatic free gasoline, since the detonation point of ether alone was below and beyond the range of the apparatus.

Column C shows the indicated thermal efficiency actually observed when each of the fuels named was tested in the variable compression engine. The efficiencies given in this and other columns stating efficiencies are based on the assumption that the available energy of each fuel is equal to its lower calorific value plus its latent heat of evaporation. Justification for this assumption will be dealt with later. Calorific values and latent heats for the fuels named here are shown in Table II.

Column D shows the relation between the indicated thermal efficiency actually observed (as shown in column C) and that which was obtained in the same engine at a compression ratio of 7:1 when using toluene, *i.e.*, 37.5 per cent is taken as = 100.

Column F gives the ratio between the indicated mean effective pressure actually observed (as shown in column E) and that obtained with a compression ratio of 7:1 and using toluene as the fuel, *i.e.*, 147 is taken as = 100.

Columns D and *F* therefore give, respectively, relative figures of merit for thermal efficiency and power output obtainable for each of the samples named.

nience, to express the tendency of fuels to detonate in terms of their equivalent toluene content. This value will in future be termed the "toluene value" of the fuel.

With the exception of alcohol and the members of its group, the efficiency obtainable with all fuels appears to be the same at the same compression ratio to within less than ± 0.5 per cent. Since the toluene value defines the compression ratio which can be used, it forms a definite and precise measure of the efficiency obtainable from any fuel when used at its most efficient compression ratio. The curve, Fig. 4, shows the observed relationship between toluene value and compression ratio, and Fig. 5 the observed relationship between toluene value and efficiency, while Fig. 6 shows the relationship between toluene value and indicated mean effective pressure or power output. The curves shown in Figs. 4 and 5 are strictly applicable to all fuels outside the alcohol group, and with but very slight amendment to that group also. The relationship between toluene value and indicated mean pressure assumes that all fuels have the same total internal energy per unit volume of mixture, which is very nearly, but not strictly, true. This subject will, however, be dealt with when discussing the maximum power output obtainable from different fuels.

Table V gives the toluene value for a large number of different samples and composite fuels. Reference to this table will show that, **of the aromatic group, benzol is markedly inferior to toluene in checking detonation, while xylene occupies a position intermediate between the two. Ethyl alcohol is by far the most effective of all. With the exception of ether and acetylene, the members of the paraffin series are the worst, and, generally speaking, their tendency to detonate increases with increase of molecular weight.** In the estimates of toluene values, the standard aromatic free gasoline is taken as zero, and toluene as 100 per cent.

It would possibly have been better to have selected either a pure paraffin fraction or a range of pure paraffins as a zero standard, but neither of these was procurable either in sufficient quantity or of a sufficient degree of purity for the purpose. It must be borne in mind when making comparisons that, although the aromatic free gasoline contains less than 2 per cent of aromatics, it does, nevertheless, contain a substantial proportion—about 35 per cent—of naphthenes, and that these have a positive toluene value of about 25 per cent.

Table V—Toluene Value of Various Fuels**

	A	B	C	D	E	F	G	H	J
Fuel	Specific Gravity at 15° C. (59° F.)	Approximate Composition Paraffins Per Cent by Wt.	Aromatics Per Cent by Wt.	Naphthenes Per Cent by Wt.	Highest Useful Compression in Variable Compression Engine Ratio Total Vol. / Clearance	Pressure (Lbs. per Sq. In. Gage)	Toluene Value Per Cent	Mean Effective Pressure in Supercharging Engine at Detonation Point (Lbs. per Sq. In. Gage)	Toluene Value Per Cent
Aromatic free gasoline	0.718	63.0	1.7	35.0	4.85	105.5	0.0	120.0	0.0
"A" gasoline	0.782	26.0	39.0	35.0	6.0	148.5	38.0	144.0	33.0
"B" gasoline	0.723	62.0	14.9	23.0	5.7	133.5	28.0	133.0	18.0
"C" gasoline	0.727	61.0	8.5	30.5	5.25	118.0	13.5	129.0	13.0
"D" gasoline	0.760	38.0	14.6	47.0	5.35	121.5	16.5	129.5	14.0
"E" gasoline	0.719	68.0	11.3	20.0	4.7	100.5	— 5.0	117.0	— 4.5
"F" gasoline	0.704	80.0	4.3	15.2	5.05	111.5	6.5	125.0	7.5
"G" gasoline	0.750	...	7.5	...	4.55	96.0	—10.0	115.0	— 7.5
"H" gasoline	0.767	10.0	4.8	85.0	5.9	140.5	35.0	137.0	24.0
Heavy aromatics	0.885	...	71.5	...	6.5	163.5	55.0	....	...
Kerosene	0.813	...	...	...	4.2	86.0	—22.0	....	...
Paraffin Series									
Hexane (80%)	0.685	77.0	2.7	20.0 app.	5.1	113.5	8.0	124.5	7.0
Heptane (pure)	0.691	100.0	to within 0.2%	...	3.75	72.0	—37.0	....	...
Aromatic Series									
Benzol (98%)	0.884	negligible	98	negligible	6.9*	179.0	(67)	ND	(66)
Toluene (99%)	0.870	negligible	99	negligible	>7.0	>183.0	100.0	ND	100.0
Xylene (91%)	0.862	5	91	4	>7.0	>183.0	(85)	ND	(83)
Naphthenes Series									
Cyclohexane (93%)	0.786	...	4.6	93.0	5.9*	140.5	35.0	148.0SS	38.0SS
Hexahydrotoluene (78%)	0.780	...	10.0	78.0	5.8	136.5	31.5	140.0	28.0
Hexahydroxylene (60%)	0.744	...	...	60.0	4.9	107.0	1.5	121.5	2.5
Olefine Series		Olefines		Paraf. and Naphth.					
Cracked spirit	0.757	53.0	10.0	37.0	5.55	128.0	23.5	....	...
Alcohol Group		Water							
Ethyl alcohol	0.798	1.5	...	...	>7.5	>204.0	>88.0	ND	(130)
Methyl alcohol (purified wood naphtha)	0.829	(Not fully determined)			5.2*	116.5	...	....	...
Methylated spirits	0.821	6 approx.	...	...	6.5*	163.5	...	....	...
Acetone	0.798	0.5	...	...	>7.0	>183.0	>72.0	ND	(79)
Miscellaneous				Aromatic free by vol.					
Ether 50% with A.F. gasoline	0.727	2.5 approx.	...	50.0	3.9	77.0	—32.0	....	...
Ether	0.735	5.0 approx.	...	...	(2.95)	(47.5)	(—64)	....	...
Carbon disulph. 50% and A.F. gasoline	0.994	...	...	50.0	5.15*	115.0	...	....	...
Carbon disulph.	1.270	...	...	...	(5.4)	(123.0)	(18)	(134)	(20)

Notes.—** The toluene value of a fuel bears a definite straight line relation to the maximum compression ratio that can be used without detonation. The author establishes the scale of values (as will be seen by reference to Fig. 4) by arbitrarily assuming that the standard aromatic free gasoline used as the basis for comparison has zero toluene value and that toluene has 100 per cent toluene value. The standard gasoline can be used without detonation when a maximum compression ratio of 4.85 is employed while toluene can be used with a maximum ratio of 7.8. If these values be plotted on a chart using compression ratios as ordinates and toluene values per cent as abscissas, and the points be joined by a straight line continued to the left of the zero toluene ordinate, as is done in Fig. 4, the toluene value is easily read off when the maximum useful compression ratio is known. When the compression ratio is less than 4.85 the toluene value will be negative. Thus the toluene value can be considered as an index of susceptibility to detonation. The higher the toluene value, the higher the compression ratio that can be used without detonation and vice versa.—EDITOR.

*Where this mark appears it indicates that the value given could not be exceeded due to preignition intervening before audible detonation.

( ) Where toluene values and highest compressions are bracketed thus it indicates that the values could not be arrived at from direct results owing to the detonation point being beyond the range of the apparatus. In such cases the values given are derived from extrapolation of the curves (which are practically straight lines) obtained from mixtures with aromatic free gasoline.

ND Indicates that there was no detonation up to the limit of mean effective pressure obtainable with full supercharge.

SS Cyclohexane did not behave normally in the supercharging engine. In the case of the other samples of naphthenes the toluene values arrived at from the variable compression engine exceeded those from detonation tests made in the supercharger. All the naphthenes, however, were alike in that there was a greater tendency to preignition than with the aromatics.

If a fuel consisting of a similar range of paraffins only had been selected as forming a datum line, then the aromatic free gasoline would have a positive toluene value of about 10 per cent. The standard aromatic free gasoline was selected because it was available in very large quantities, and, the whole bulk of it having been prepared at one operation, its consistency could be relied upon as being uniform—a very important factor in the case of a fuel used throughout as a standard basis for comparison.

Ether and acetylene and the heavier paraffins have, therefore, minus values, while hexane (a very light paraffin) has a very slightly positive value. In the case of the paraffin series it was found difficult to determine the detonation point of the heavier members of the group, partly because these could not be isolated in sufficient quantities or of a sufficient degree of purity for the purpose, and partly because a considerable amount of heat had to be added to sufficiently vaporize them.

There was, however, considerable evidence to show that the toluene value falls as the molecular weight increases. Small quantities of heptane of a very high degree of purity were eventually obtained, and it is hoped that sufficient supplies of both octane and nonane may soon be procured. The results obtained on heptane were as interesting as they were surprising, for, contrary to all expectations, not only did this fuel detonate far more readily than the aromatic free gasoline of which it forms one of the relatively lighter constituents, but when used pure it detonated with a compression ratio of only 3.75:1, and when mixed with hexane, even in quite small quantities, it increased the latter's tendency to detonate.

Experiments on the variable compression engine showed that heptane had a negative toluene value of minus 37 per cent. The particular sample of heptane with which the experiments were conducted was of a vegetable origin. Before any tests were run, it was very carefully analyzed, and, but for a small proportion, about 3 per cent, of terpenes was found to be remarkably pure. The results obtained were so unexpected that suspicions were aroused as to the possible influence of the presence of terpenes. Experiments with mixtures of gasoline and turpentine, however, showed that the addition of turpentine served to reduce the tendency to detonate. Finally, the remainder of the heptane was eventually almost completely freed from terpenes, and its purity raised to over 99.5 per cent; but, even so, its behavior was not influenced to any perceptible degree.

The quite remarkable difference observed between the behavior of hexane and heptane, two contiguous members of the same series, emphasizes very strongly the necessity for taking nothing for granted, and for investigating, individually, the behavior of each member of a series; moreover, there is reason to believe that certain other members of the paraffin series behave in the same erratic manner.

In this connection it may be of interest to note that a sample of commercial kerosene consisting mainly of heavy paraffin fractions detonated at a compression ratio of 4.2:1. This is equivalent to a toluene value of minus 22 per cent. Under the same conditions of heating the toluene value of hexane was found to be plus 8 per cent and of pure heptane to be minus 37 per cent. However, in spite of the above and possibly other notable exceptions **there is some evidence to show that as a general rule the heavier members of the paraffin series detonate more readily than the light ones.** Applied to this series, and to this series alone, the accepted specification, based on boiling points, affords a very approximate indication of the quality of the fuel; but that when only a small percentage of aromatics or even naphthenes are present, the position is entirely reversed, and the whole basis of the accepted specification at once falls to the ground.

(*To be continued.*)

Progress of American Engineering Standards Committee

THE American Engineering Standards Committee has approved "Tentative American Standard Specifications and Tests for Portland Cement," "Tentative American Standard Specifications for Fire Tests of Materials and Construction," and "American Standard Pipe Threads." Moreover there has been submitted for approval by the committee the "National Electrical Code" as an American Standard, and "Standard Test for Toughness of Rock," "Standard Method of Distillation of Bituminous Materials for Road Treatment" and "Standard Method of Sampling Coal" as Tentative American Standards, with the "Safety Code for Head and Eye Protection" submitted for approval as "Recommended American Practice."

The committee is composed of 47 members representing 17 bodies or groups of bodies, including 6 national engineering societies, 5 governmental departments and 13 national industrial associations. The Society of Automotive Engineers is a member body. Its function is merely to see that each body or group concerned in a standard shall have opportunity to participate in its formulation, which is in the hands of a working committee, technically called a "sectional committee." Each sectional committee is organized by one or more of the principal bodies interested, such bodies being known as "sponsors." Sponsorships have been arranged for the following projects which were under way at the beginning of this year:

Electrical Projects—"Rating of Electrical Machinery" and "Term Markings for Electrical Apparatus."

Mechanical Projects—"Ball Bearings," "Plain Limit Gages," "Gears," "Machine Tools," "Nut and Bolt Heads," "Pipe Flanges and Fittings," "Screw Threads," "Shafting."

General Projects—"Passenger and Freight Elevators," "Color Scheme for Pipe Lines," "Steel Shapes," "Zinc Ores and Zinc."

Safety Codes—"Aviation Safety Code," "Construction Work," "Electrical Fire Code," "Electrical Safety Code," "Floor Openings, Railings, Toe Boards," "Foundries," "Gas Safety Code," "Grinding Wheels," "Head and Eye Protection," "Ladder Code," "Lighting Code," "Lightning Protection," "Logging Operations and Sawmill Machinery," "Machine Tools," "Mechanical Transmission of Power," "Paper and Pulp Mills," "Electrical Power Control," "Power Presses," "Mechanical Refrigeration," "Industrial Sanitation," "Stairways, Fire Escapes and Other Exits," "Textiles," "Ventilation," and "Woodworking Machinery."

On Dec. 8, 1920, at a conference at which more than 100 organizations were represented, it was unanimously voted that a comprehensive program of safety codes should be undertaken. Active work is in progress on 24 such codes.

THE Engineering Subcommittee of the Empire Motor Fuels Committee, under the chairmanship of Dr. W. R. Ormandy, is conducting tests and experiments on the design and operation of internal combustion engines running on alcohol fuel and on alcohol-benzol-ether mixtures.

Analyzing of the Elements of Production Cost

The following paper discusses production costs from the angle of the industrial executive. It is a practical analysis of the kind for cost knowledge needed, viewed from that standpoint, and was read before a recent meeting of the Pittsburgh Section of the Industrial Cost Association.

By W. E. Hundley

WE are not here this evening to discuss elementary principles of cost accounting. I assume that everyone present is more or less familiar with the usual formula found in text-books and referred to in most publications regarding costs; namely, that direct material, plus direct labor, plus manufacturing expense, equals manufacturing cost.

No doubt the equation is fundamentally correct, but I am going to ask you to consider Cost of Production from a somewhat different angle; to forget the narrow accounting view of the problem and to look at it from the standpoint of the stockholder and the Industrial Executive. These men are vitally interested to-day in getting maximum production at minimum cost, and they must know *definitely* what constitutes that cost if any progress is to be made toward reducing it.

We are now confronted with a situation that demands an immediate and thorough analysis of the vital facts that are back of the figures we are using.

We must take time to analyze our cost problem; to consider each factor that enters into it, and to determine the most practical method of applying the indirect charges which cause most of our trouble in calculating Cost of Production. To do this effectively we must first visualize the problem as a whole. We must stand off and get a good general view of the big basic sources of cost.

When we approach the subject in this way we find that the manufacturing and marketing of an industrial product involves seven fundamental factors, each spelled with an "M," which might appropriately be called "The seven M's of industry":

First—Money. **Fourth—Machinery.**
Second—Millsite. **Fifth—Material.**
Third—Mill. **Sixth—Men.**
Seventh—Management

Each of these factors is the primary cause of certain expenditures which begin as soon as an enterprise is launched and continue as long as it exists. It is no more difficult for a capable cost accountant to classify expenditures with respect to these causes than it is for the naturalist to tell from the characteristics of a leaf the kind of tree on which it grew. I will endeavor to show how the ordinary expenditures of an industrial enterprise are related to these prime sources of cost and how they may readily be classified into three main groups:

First: Administration.
Second: Production.
Third: Distribution.

The first factor, **Money,** is the motive-power of industry. It is obtained, primarily, by financing the enterprise and represents wealth accumulated by men who are willing to risk the loss of it by exchanging it for pieces of paper which entitle them to participate, under certain conditions, in the profits which they feel assured will be earned by the venture and which they believe will exceed the ordinary rate of interest afforded by other investments involving little or no risk.

This return, which they expect to receive on their investment, is a combination of interest for the use of their money and profit for conducting the enterprise, which should be in proportion to the risk involved and cannot reasonably be expected to approximate a fixed rate for all industries. This has been duly recognized in England, where the percentage of profit allowed on invested capital, for income tax purposes, varies with the class or nature of the business.

I mention this matter of interest and profit because it has a certain bearing upon the problem we are going to discuss and cannot be entirely ignored, as it is still the storm center among professional cost accountants and engineers, many of whom contend that interest on investment *must* be included in determining Cost of Production, reasoning that an enterprise must pay for the use of capital before it can show a profit.

We will have to put ourselves on record, sooner or later, on this point, but I think we need not include it in our discussion this evening.

This factor of **Money** involves the employment of treasurers, credit managers, comptrollers and auditors, with their retinue of clerks and accountants concerned primarily with the handling of receipts and disbursements, the recording of transactions with employees, customers and creditors and the keeping of accounts which reflect the financial condition of the business and guide the management in directing its activities and determining its policies.

All expenses in connection with the housing and maintenance of this organization, which are common to the business as a whole and cannot be apportioned on any equitable basis to productive departments or product and have no direct bearing upon "Distribution," are classified as "Administration."

Millsite, the second factor, although it plays a most important part in the economy of production and often limits the extent to which improvements may be made that would tend to reduce costs, is not, of itself, the source of much expense, and has very little effect upon Cost of Production.

Money spent for a millsite constitutes a permanent investment which can neither be depreciated nor appreciated and on which no direct profit can be realized except through rental or sale.

Taxes and maintenance are the usual items of expense, and these are apportioned to Production on the basis of space occupied by each department or building.

Mill, the third factor, constitutes an important element of investment which is slowly absorbed into Cost of Production through the medium of depreciation charges and also is the source of certain expenditures which may readily be classified as "Building Expense," and apportioned on the basis of available floor space or cubic contents. These expenses are of two classes:

First—A more or less fixed expense, independent of production, which includes such items as depreciation, taxes, insurance, fire protection and general maintenance.

Second—A variable expense, increasing with the use of buildings and the number of men employed, including light heat, water, ventilation, elevator service, janitor service, etc.

Under normal conditions this distinction is not important, but when certain departments are idle or production is curtailed the difference in expense may be worth considering.

Machinery, the fourth factor, which embraces all mill equipment directly or indirectly connected with manufacturing, is the most important element of invested capital and the source of most trouble for the industrial executive, the cost accountant and the income tax examiner in determining Cost of Production.

It used to be very difficult to persuade manufacturers that depreciation of machinery and equipment constituted an important element of cost. Now they not only swallow depreciation but they hunger and thirst for amortization, obsolescence and inadequacy, and the cost accountant, who is trying to show actual Cost of Production, has a hard time keeping his feet on the straight and narrow path while trying to satisfy the demand for this home-brew concoction made in accordance with the formula handed out by the income tax department.

It is most important at this time to know the actual valuation of plant equipment; the value in use, and this, of course, cannot be satisfactorily determined without making some kind of an appraisal which entails adjustment of book values. Depreciation allowances charged into cost from year to year are merely estimates for accounting purposes and cannot be depended upon as an indication of actual depreciation. Unless the reserves set up have been properly handled, the balance when deducted from the book value of the assets may show a valuation that cannot be reconciled with the actual physical condition of the equipment. This is frequently found to be the case where large amounts have been charged for repairs and maintenance, which, in fact, have involved important renewals or replacements and, in some instances, complete rebuilding of machines, disguised under the familiar mask of "General Overhauling."

Assuming that we can establish a reasonably accurate cost for machinery and equipment, we have a basis for determining the charges to be made to Cost of Production for the gradual wear and tear which will eventually cause the scrapping or disposal of such property, regardless of how much may be spent for repairs and maintenance. But the extent to which the repairing of machinery tends to prolong its useful life is an important consideration.

Machinery is a constant source of expense, whether idle or operating, and we may, therefore, very properly assemble the items of this expense under these two headings:

1—Idle Machine Expense.
2—Operating Machine Expense.

Idle Machine Expense includes the items usually referred to as fixed charges, such as

Depreciation—Insurance—Taxes—Space Charges—Small Maintenance Charges.

Operating Machine Expense covers all of the above charges plus the following, which vary more or less with production:

Wages of Operator—Indirect Labor—Labor Expense—Power — Tools — Supplies — Maintenance and Repairs — Crane Service—Miscellaneous Works Expense.

In departments where the work is done chiefly by machines a cost per hour can be calculated for units, groups or classes of machines. Where the work is done chiefly by hand hourly rates can be developed for various classes of labor or occupations which will absorb all expense of maintaining the equipment used.

These plans constitute what are generally known as machine-rate and man-hour cost methods. Some accountants prefer to figure separate hourly rates for machines and operators but the combined rate works out very satisfactorily in practice if reasonable care is exercised in checking the rates from month to month.

Material, the fifth factor, is generally considered an easy matter to dispose of chiefly because the tendency is to ignore most of the expenses incurred in connection with it, absorbing them as part of the "General Manufacturing Expense." As in the case of labor we have both direct and indirect Material Costs.

Direct Material Cost should include all items which can be charged direct to a particular quantity, lot or class of material, such as—Amount of Invoice—Freight, Express or Drayage—Cost of Unloading—Labor Charges for Cutting, Grading, etc., and should be credited with such items as—Cost of Containers—Allowances and Adjustments, etc.

Some accountants argue that cash discounts should also be deducted from invoices.

Indirect Material Cost should cover all other expenses incurred in connection with material until it is delivered to the department that has requisitioned it. It would include—Purchasing—Tracing—Demurrage and Switching Charges—Inspecting and Testing—Storing—Handling—Breakage and Shortage—Repairing and Adjusting—Returned Goods Expense—Inventory Expense—etc.

Special expenses in connection with material bought for a particular job should be charged direct to the shop order covering it and in some cases charges for demurrage, inspection, testing, etc., might be charged direct to a department. Otherwise, Indirect Material Cost should be distributed on some equitable basis that would take account of weight, bulk, etc. This might necessitate classification of material into several groups, each group having a common unit of measure such as weight, pieces, feet, etc., but there would always be certain general expenses that would have to be distributed on some such basis as the number of requisitions handled, or the total direct cost of purchases.

Applying a percentage on cost of material disbursed is the favorite answer to this problem, but it is just as inaccurate and illogical as using a "General Factory Burden."

There are other phases of the Material Factor that will stand a good deal of discussion. I refer to the proper disposition of charges for defective and spoiled material; the use of average cost, lot cost or last cost; the proper allowance to be made for normal waste; and to what extent salvage value should be credited to direct material cost.

Men, the sixth factor mentioned, not only constitute the greatest problem in the industrial world, but are the direct source of so many expenses that cost accountants as

a rule, have used what they call, "Productive Wages" and "Productive Hours," as an arbitrary basis for distributing all "Manufacturing Expense."

I need hardly say that such items as power, tools, supplies, repairs, etc., cannot be thrown into a melting pot called "Burden" and distributed to production on a basis of wages or labor hours if we are to get anything approximating actual costs. But we can and should analyze wages and the expenses incurred in connection with the employment and handling of men and classify them into groups as, for instance:

1—Direct Labor. 2—Indirect Labor. 3—Departmental Labor Expense. 4—General Labor Expense.

Direct Labor would consist of all wages paid for time actually consumed by employees when engaged on operations or processes definitely identified with shop orders or with units, lots or classes of material for product (regardless of the purpose for which such material or product might be used).

Indirect Labor would include all wages paid to employees for work that could not be charged to productive operations, processes, etc., such as—

Supervision—Inspection—Testing—Checking—Helping —etc.

Departmental Labor Expenses would constitute direct charges to operating departments for lost time of employees and expenses resulting from Defective Work—Delayed Operations—Idle Time—Instruction—etc.

General Labor Expense would cover all expenditures for maintenance of the departments which deal directly with the men and the expense of which could readily be distributed on the basis of total man-hours, men employed, men handled, etc., such as

Employment Department—Time Keeping Department—Hospital—Safety-First Department—Police Department—Welfare Department—Educational Department—Cafeteria.

As to the method of charging labor to Cost of Production there is much to be said in favor of a system of average rates for classes of labor worked out by departments and occupations, and for the practice of establishing hourly rates combining labor and expense for departments where work is done mostly by hand. This plan has been satisfactorily carried out in foundry practice and on repair work for carpenters, painters, bricklayers, tinners, electricians, pipefitters, plumbers, riggers, etc.

Management, the seventh factor, affects Administration, Production and Distribution, but it does not present any particular difficulties except in connection with Production.

Under "Administration" we find the salaries of all executives who are not identified with Production and Distribution. Also such items as legal expenses, traveling, telephone and telegraph, association dues, donations, etc.

Under "Distribution" are the salaries and expenses of the Sales Manager and the sales force, branch office expenses, advertising department, etc. If the company distributes its product locally there may also be the expense of operating motor trucks.

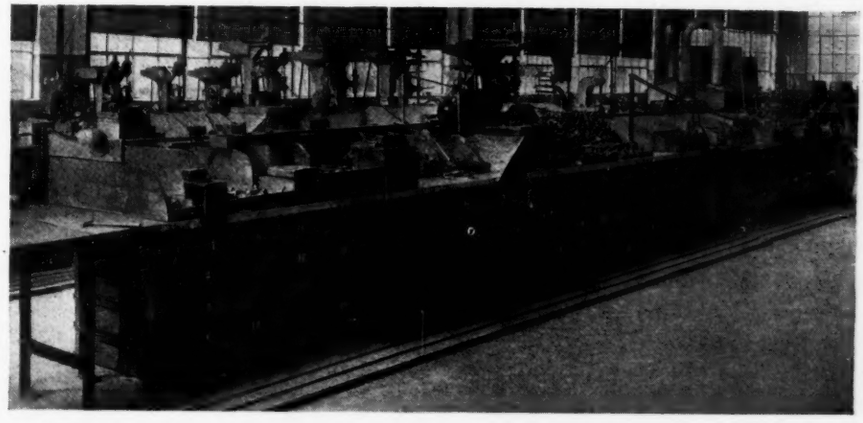
Management of Production involves a certain class of expenses which are variously referred to as "General Manufacturing Expense," "Plant Administration," etc. As a rule these expenses cannot be applied as direct charges to productive processes or operations but there is one element that is frequently separated and handled as a productive department. Engineering and Drafting can and should be handled on an hourly basis, each shop order, or department being charged with the direct time of engineers and draftsmen, as reported daily and a cost rate established to absorb all salaries and expenses.

The departmental activities generally identified with the Production Manager and which cannot be distributed on hours of direct labor are:—General Supervision—Planning and Dispatching—Timesetting—Inspection—Packing and Shipping—Works Accounting and Records—Costs and Statistics.

These general expenses of Production must be distributed on some equitable basis to departments, processes and operations but there is seldom a satisfactory basis available for this purpose. Theoretically each operating department should absorb an amount of this expense proportionate to its activity. Neither the hours nor wages of direct labor will adequately express the activity of all departments. Total hours or wages of direct and indirect labor would be a nearer approximation but even this would not be an adequate measure for departments consisting chiefly of machines. Inasmuch as the Production Manager is concerned with every feature of direct and indirect cost in each department, the total cost of operation is perhaps the best basis available. Pro-rating the expense on this basis would reach every department and keep every department manager on his toes to hold down his cost of production.

Tool Lockers Under Benches

ONE of the problems in any machine shop or manufacturing establishment is what to do with tools at night. The Holley Carburetor Co. has solved this problem in a very ingenious manner and in a way which has resulted in saving both time and space. In the system where the workman turns in all of his tools at the tool crib at night, a long line-up results with the consequent loss of time. In the morning he has to go with his tool checks again and another delay occurs. In the Holley system each man has a tool box of his own provided with a number and lock. This box is placed below the bench and contains just what the workman needs to go on with his work.



Tool boxes placed beneath work bench give a compact storage space and eliminate delay at the toolroom window

Striking Survey Shows Success of Farmer-Owner with Tractor

Results of a recent tractor survey by the Agricultural Experiment Station of the University of Idaho are presented. The facts are of special interest, as showing the success obtained by the farmer-owner as opposed to expert handling a new machine in national tractor demonstrations.

By John C. Wooley

THE national tractor demonstrations have shown that while new and in the hands of experts the tractor will do the work it is designed to do. These demonstrations have been very valuable aids in the development of the tractor as a form of power and of the business of making tractors. At the present time, however, we are most interested in knowing what success the farmer-owner is having with his machine. In order to secure information regarding the success of the tractor on the farm questionnaires were sent to 520 tractor owners. Two hundred twenty-six answers were received. One hundred twenty-seven of the questionnaires were filled out completely and it was from these that the conclusions were drawn.

Several studies were made of these data and some of the results are given below:

Study Number 1

PURPOSE.—To determine the success with which tractors have been operated in Idaho during the past ten years.

Date of Purchase	Has the Tractor Been a Paying Investment? Yes	No
1908	1	2
1909	0	2
1910	0	0
1911	2	0
1912	2	2
1913	1	0
1914	9	4
1915	15	7
1916	14	10
1917	42	14

Of the 127 reports, 86 indicated the tractor as a profitable and 41 as an unprofitable investment. In other words, 69.3 per cent of all the tractors that have been used in the state have been profitable. Considering alone the tractors purchased in 1917, we find that 75 per cent of them have been profitable to their owners. Some of the failures are due to poorly designed machines, but in many cases the trouble can be traced to a lack of knowledge regarding the care and proper method of operation of the machine, or to carelessness on the part of the operator.

The selection of the proper size and type of machine also has much to do with its success or failure.

Study Number 2

PURPOSE.—To find the relation of size of farm to the success of the tractor.

On less than 200 cultivated acres	70%	were successful
On 200 to 300 cultivated acres	81.5%	were successful
On 300 to 400 cultivated acres	50%	were successful
On 400 to 500 cultivated acres	77%	were successful
On 500 to 600 cultivated acres	75%	were successful
On 600 to 700 cultivated acres	57%	were successful
On 700 to 800 cultivated acres	63%	were successful
On over 1000 cultivated acres	78%	were successful

It is seen from this that the highest percentage of success was secured on the small farm and the next best results were secured on the farms with over 1000 acres in cultivation. On the smaller farm the owner was in all probability his own operator, which, no doubt, has something to do with this high percentage of success. On the larger ranch there is a tendency to overload the machine and this at once makes the tractor an unprofitable investment. On the largest ranches an expert operator is often hired and less loss of time and less expense is usually the result.

Study Number 3

PURPOSE.—To determine the relation of size of tractor to the profitableness of the investment.

Size	No. Reported Profitable	No. Reported Unprofitable
8-16 horsepower	10	5
10-20 horsepower	16	3
12-25 horsepower	18	8
15-30 horsepower	14	7
20-45 horsepower	13	6
30-60 horsepower	7	4
40-75 horsepower	5	1

The higher percentages here are found in the 10 to 12 draw bar horsepower class and in the 40-75 size. The smaller type has been, in most cases, used to supplement the horsepower on the farm, while in many cases, the larger type has been used for all the work on the wheat ranch. Both have been found profitable investments.

Study Number 4

PURPOSE.—To find the size of tractor favored by owners of different size farms.

Cultivated Areas	Favored Size
Less than 100 acres	8-16 horsepower
100-200 acres	12-25 horsepower
200-300 acres	10-20 horsepower
300-400 acres	20-40 horsepower
400-500 acres	12-25 horsepower
500-600 acres	15-30 horsepower
600-700 acres	25-50 horsepower
700 acres and over	40-75 horsepower

The size of tractor selected will depend upon other factors beside the size of farm. One of these factors is the requirement for belt power. Another is the type of soil and still another is the type of farming. On the specialized wheat ranch, where the plowing, disking, seeding and harvesting can be done with the tractor, one of the larger

sizes will be necessary for success. While on a ranch where diversified farming is followed, one or two smaller machines may be more successful.

Study Number 5

PURPOSE.—To determine the effect of dependability on success of the tractor.

Size of Tractor	Number Reporting	Profitable Days Out of Repair When Needed	Unprofitable Days Out of Repair When Needed
Less than 10 D. B. Hp.	26	8.3	60
10 to 16 D. B. Hp.....	42	3.2	30
Over 16 D. B. Hp.....	21	7.0	33
Average	..	6.1	41

Note.—D. B. Hp. is the abbreviation for Draw Bar Horsepower.

Dependability is one of the most important factors in the success or failure of the tractor as an investment. If the tractor can be depended on to work when the busy season comes, it proves to be, in most cases, a profitable investment. Where it fails in the busy season, it is certain to be a marked failure.

Study Number 6

PURPOSE.—To find the number of horses displaced by different size tractors and to determine the effect of this displacement on the success of the tractor.

Size of Tractor	—Horses Displaced— By Profitable Machines	By Unprofitable Machines
Tractors less than 10 D. B. Hp...	4	2
10 to 16 D. B. Hp.....	7	4
Over 16 D. B. Hp.....	14	6

In every case the tractors reported as having been profitable investments have displaced a larger number of horses than those that have not been reported as profitable. A tractor can be made more easily a financial success if it displaces some horses, but quite a few owners feel that they have made money by supplementing the horse power with the tractor. They have taken some of the hardest work off the horses and have had an abundance of power for the rush seasons.

Study Number 7

PURPOSE.—To determine the effect of the tractor on the labor situation.

Size of Tractor	Percent of Owners Reporting a Decrease in Hired Help: Profitable Machines	Unprofitable
Less than 10 D. B. Hp.....	73%	12½%
10 to 16 D. B. Hp.....	83%	19%
Over 16 D. B. Hp.....	90%	55%

Eighty-two per cent of all tractor owners reported that the tractor enabled them to get along with less hired help. The men who have been able to displace some man labor with their machines are the ones who in a majority of cases have made the greatest financial success with these machines.

Study Number 8

PURPOSE.—To find the different farm operations in which the tractor is being used in Idaho.

Ninety-seven per cent of the owners make the greatest use of the tractor in plowing. A few operators use their machines in plowing as many as 120 days each season.

About one-third of the owners use their tractors in the preparation of the seed bed. A large number of the men who use their tractors in this work are among the successful operators. By use of the tractor this work can be done rapidly and without expensive equipment, and such use will help the tractor to pay its way.

Twenty per cent of the owners use their machines for harvesting and about 40 per cent of the machines are used in threshing. Clearing of land, pumping, silo filling, feed grinding, grading, and hauling are other lines of work in which the tractor is being used successfully.

Study Number 9

PURPOSE.—To learn the troubles that tractor owners encountered.

Quite a large number of men have reported trouble with ignition and in almost every case this has been due to dust that has found its way into the magneto. A dust-proof cover should be carefully kept in place and by this means much of this trouble will be avoided.

Lubrication was one of the difficulties encountered last season. Some of the most successful operators are the ones who take the greatest care with their lubricating oil. Lubricating oil is destroyed by being burned, by being cut with kerosene that works past the piston rings, and by being worn out in the bearings and cylinders. One successful operator drains his crank case at the end of each day's run. He allows the oil to stand until morning and then pours off any washy material and filters the remainder. At the end of one week he uses new oil in the crank case. Tests have indicated that the oil should be changed after thirty hours of work where the engine is being operated under maximum load. Trouble with bearings, with rings, and with loss of power are very often the result of poor lubrication.

Gears and chains come in for a large share of the trouble in this State, due to the large amount of dust that prevails. It is well to inspect the gears and chains often and thus anticipate the need for new parts.

Study Number 10

PURPOSE.—To determine the items in tractor cost to the owner.

One of the items that is quite important is that of deterioration. If a tractor gives service for only five years, then one-fifth of the original cost must be charged to deterioration each year, and at this rate this will be one of the big items. If the tractor will give service for ten to twelve years, as it should under proper usage, then this item will not be so great. Loss of time when power is most needed is an expensive item and must be avoided by care in operation and by effective service on the part of the dealer, in case of a breakdown during the busy season. Fuel and oil should probably be listed next, with repairs as one of the lesser items in cost. Fuel and oil costs for plowing should be kept below 50 cents per acre. The other items of cost are so variable that no accurate figures can be given.

Conclusions

1. The tractor, when carefully selected and intelligently operated, is a profitable investment.

2. The farmer must be able to make all minor repairs himself and to get repairs and expert help quickly for larger installations.

3. Dependability is probably the largest factor in the success of the tractor.

4. The three plow size is favored in this State.

5. Proper care of lubrication will prolong the life.

6. The best quality of oil is the cheapest.

7. The tractor motor is required to pull its rated load the greater portion of the time. The automobile motor is very rarely subjected to full load for a ten-hour day. Care for the tractor accordingly.

8. The tractor that displaces half its value in horses can easily be made to pay its way.

9. The man who makes up his mind to care for his machine and to be as independent as possible of outside help is the satisfied owner.

10. Taking off one plow may enable the tractor to operate at its rated speed and bring better results.

11. Overloading brings trouble and reduces results.

Foreign Import Duties on American Automotive Products

Argentina:
Cars and trucks.....32% A.V.
Motorcycles .....$36.80 each
Parts .....32% A.V.

Bolivia:
Cars ..... 8% A.V.
Trucks ..... 4% A.V.
Motorcycles .....15% A.V.

Brazil:
Cars and trucks....7% A.V. nominal duty: 25.71% A.V. actual duty. See note *.
Chassis mounted or not; front or back wheels complete; including motor and accessories rough, but not including body.20.57% A.V.
Bicycles, including solo motor cycles (engines are dutiable separately), per 100 lb.....$20.15
Motors and engines, including those for motorcycles.....46.28% A.V.

Chile:
Trucks, not otherwise specified for the transportation of merchandise assembled or knocked down and separate parts of the same not subject to other duties, per 100 lb..... $3.31
Automobile bodies imported separately, per 100 lb. gross.. 16.48
Cars and car parts, per 100 lb. 9.95
Up to 2204 lb.—$6.63 for each 100 lb. exceeding 2204 lb.
Motor and frames or chassis for automobiles, per 100 lb.. 1.66
Motorcycles, per 100 lb..... 24.86

Columbia:
Cars and trucks, per 100 lb... 0.4731
Motorcycles, per 100 lb..... 2.365

Ecuador:
Automobiles .....Free. 2% A.V. surtax
Motorcycles, per 100 lb. Surtax included $1.0153

Paraguay:
Cars and trucks.....63.5% A.V.
Motorcycles .....$65.52 each

Peru:
Trucks, per 100 lb..... 5.30
Cars and motorcycles per 100 lb. 15.92
See note **.

Uruguay:
Automobiles and taxis.....29% A.V.
Motorcycles .....$82.72 each, plus 14% A.V. surtax

Venezuela:
Automobiles and trucks, per 100 lb. $0.6853
Motorcycles, per 100 lb..... 3.4330

Costa Rica:
Trucks for province of Limon, per 100 lb..... 1.3314
Trucks for interior provinces, per 100 lb..... 1.2933
Cars and motorcycles for province of Limon, per 100 lb.... 4.4381
Cars and motorcycles for interior provinces, per 100 lb.. 4.3113

Cuba:
C. T. & M.....25% A.V.

Dominican Republic:
Cars and passenger omnibuses. 5% A.V.
Trucks .....Free
Motorcycles .....10% A.V.

Haiti:
Cars, trucks, motorcycles.....24% A.V.

Guatemala:
Automobiles, trucks and motors (gross weight), per 100 lb.... $4.64
Motorcycles and parts (gross weight), per 100 lb..... 6.95

Honduras:
Cars and trucks, per 100 lb.... 12.50
Motorcycles, per 100 lb..... 5.00
Note: Surtax of $0.14 per 100 lb. on imports into Amalpa.

Nicaragua:
Cars, trucks, motorcycles and parts ..... 5% A.V.
Surtax .....12½% of duty

Panama:
Cars, trucks, motorcycles and parts .....15% A.V.

Salvador:
Cars, trucks, motorcycles and parts, per 100 lb..... $2.30

Mexico:
Trucks under 1100 lb, per 100 lb. 6.21
Trucks over 1100 lb. per 100 lb. 2.48
Cars not over 550 lb. (gross), per 100 lb..... 18.66
Cars from 550 to 1650 lb. (gross) 14.93
Cars over 1650 lb. (gross), per 100 lb. 12.44
Motorcycles, per 100 lb..... 24.98

British Guiana:
C. Tr. M. parts, etc., General..22% A.V.
Preferential .....11% A.V.
Invoice surtax, 1½% A.V. and surtax of 10% of duty.

Dutch Guiana:
C. Tr. M. parts, etc.....10% A.V.

French Guiana:
Automobiles under 5500 lb....50% A.V.
Automobiles over 2500 lb., per 100 lb..$11.80, plus 5% A.V. Octroi duties
Motorcycles, per 100 lb., $28.05 plus 5% A.V.

Canada:
C. and Tr. of all kinds, including motorcycles, chassis, bodies and steel wheels.
General .....35% A.V.
Preferential 25%

New Foundland:
Cars, trucks and motorcycles..45% A.V.
Surtax 10% of duty.

British Honduras:
General .....15% A.V.
Preferential .....10% A.V.

Antigua:
General .....13.33% A.V.
Preferential ..... 8.88% A.V.

Bahama Islands:
Cars and trucks. General.....20% A.V.
Preferential .....15% A.V.
Motorcycles. General .....50% A.V.
Preferential .....37.5% A.V.
Parts .....

Barbados:
C. trucks and motorcycles....10% A.V.

Bermuda:
Automobiles and motorcycles are prohibited.

Dominica:
General .....12.5% A.V.
Preferential ..... 8.33% A.V.

Grenada:
General .....10% A.V.
Preferential ..... 6.66% A.V.

Jamaica:
Motor cars and accessories.
General .....20% A.V.
Preferential .....15% A.V.

Montserrat:
General .....13.33% A.V.
Preferential ..... 8.88% A.V.

St. Christopher and Nevis:
General .....11% A.V.
Preferential ..... 7.33% A.V.

St. Lucia:
General .....16.5% A.V.
Preferential .....11% A.V.

St. Vincent:
General .....12.5% A.V.
Preferential ..... 8.33% A.V.

Hongkong: .....Free
Straits Settlements: .....Free
Gibraltar: .....Free
Hawaii:
Philippines: .....Free
Porto Rico: .....Free
Guam: .....Free
Virgin Islands, U. S......Free

Cypress:
Cars and trucks.....Free
Articles not specified. General 8% A.V.
Preferential ..... 6.66% A.V.

Malta:
Cars, trucks and motorcycles.15% A.V.

China:
Cars.. trucks and motorcycles.. 5% A.V.
Surtax 10% of duty.

Tutuila:
Cars, trucks and motorcycles..10% A.V.

Trinidad and Tobago:
Motorcycles and trucks.
General .....15% A.V.
Preferential .....10% A.V.
Cars. General .....30% A.V.
Preferential .....20% A.V.

Australia:
Cars: 1. Single seated bodies.
General .....$194.40 each
Preferential .....135.80 each
2. Double seated bodies.
General .....271.60 each
Preferential .....243.00 each
3. Bodies with fixed or movable canopy tops such as limousines, etc.
General .....364.50 each
Preferential .....315.90 each
4. Chassis: Unassembled.
General .....17% A.V.
Preferential ..... 7.5% A.V.
Assembled:
General .....20% A.V.
Preferential .....10% A.V.

British India:
Cars and motorcycles.....20% A.V.
Trucks ..... 7.5% A.V.

Ceylon:
Motor vehicles ..... 7.5% A.V.

Federated Malay States:
Motor vehicles .....10% A.V.

North Borneo:
Vehicles .....10% A.V.

New Zealand:
Cars, trucks and motorcycles.
General .....20% A.V.
Preferential .....10% A.V.

Aden: .....Free

Japan and Chosen:
Cars and trucks. General.....50%
Conventional 35%
Motorcycles .....$46.61 each

Siam:
Cars, trucks and motorcycles.. 3% A.V.

French Indo-China:
Cars and trucks under 5500 lb..45% A.V.
Cars and trucks over 5500 lb, per 100 lb.....$11.80
Motorcycles, per 100 lb..... 28.05

Dutch East Indies:
Carriages, including automobiles .....10% A.V.
Not specified ..... 6% A.V.

Persia:
Cars, trucks and motorcycles..15% A.V.

Syria:
Cars, trucks and motorcycles..11% A.V.

Abyssinia:
Cars, trucks and motorcycles..10% A.V.

Belgian Congo:
Cars, trucks and motorcycles..10% A.V.

Egypt:
Cars, trucks and motorcycles.. 8%
Local tax of ½% at Alexandria.

Algeria:
Cars and trucks under 5500 lb.45% A.V.
Cars and trucks over 5500 lb., per 100 lb.....$11.80
Motorcycles, per 100 lb..... 28.05

Nigeria:
Cars, trucks and motorcycles..Free

Mauritus:
Cars, trucks and motorcycles..12% A.V.

Zanzibar:
Cars, trucks and motorcycles.. 7.5% A.V.

Eritrea:
Cars, trucks and motorcycles.. 8% A.V.

Libya:
Cars, trucks and motorcycles..11% A.V.

Somaliland:
Cars, trucks and motorcycles..15% A.V.

Liberia:
Cars, trucks and motorcycles..12½% A.V.

Morocco:
Cars, trucks and motorcycles..12½% A.V.

Union of South Africa:
Cars and motorcycles. General.20% A.V.
Preferential .....17% A.V.
Trucks. General ..... 3% A.V.
Preferential .....Free

Mozambique:
Cars and trucks.....10% A.V.
Motorcycles ..... 5% A.V.

Czecho-Slovakia:
Cars or trucks over 5500 lb, per 100 lb. $4.54
Cars or trucks under 5500 lb...45% A.V.
Truck bodies over 5500 lb., per 100 lb. $0.90
Passenger car carriage work over 5500 lb., per 100 lb..... 6.91
Car or truck bodies under 5500 lb. .....45% A.V.

Austria:
Cars, trucks and motorcycles—
Up to 880 lb., per 100 lb.....$13.63
Over 880 to 3960 lb., per 100 lb. 11.07
Over 3960 to 7040 lb., per 100 lb. 9.22
Over 7040 lb., per 100 lb..... 5.53
When above duties are paid in paper, figures should be multiplied by 80.

Belgium:
Motorcycles, per 100 lb.....$31.54
Automobiles—Chassis with or without motor, with or without body, weighing less than 4400 lb., per 100 lb..... 21.04

From 4400 lb. to 8800 lb., inclusive:
Passenger cars, per 100 lb... 21.04
Other, per 100 lb..... 13.15
8800 lb. and more, per 100 lb.. 6.58

Bulgaria:
Motorcycles, per 100 lb. General 26.63
Minimum 19.20
Automobiles ..... 33.03 each
These duties are paid in paper and should be multiplied by 6.

Denmark:
Motorcycles, per 100 lb..... $7.30
Automobile and chassis (including motorcycle side cars), per 100 lb. 3.04
Plus 5% A.V

Finland:
Motorcycles .....$11.58 each
Cars and trucks.....10% A.V.
Above duties are to be increased 200%.

France:
Motorcycles, per 100 lb.....$28.05
Cars and trucks under 5500 lb.45% A.V.
Cars and trucks over 5500 lb., per 100 lb.....$11.80
Chassis frames for automobiles weighing 5500 lb. or more, per 100 lb. 11.80
Less than 5500 lb.....45% A.V.
Bodies of automobiles weighing 5500 lb. or more:
Trucks, per 100 lb..... $3.68
Passenger cars, per 100 lb 23.19
Bodies weighing less than 5500 lb. .....45% A.V.

Faroe Islands:
Cars, trucks and motorcycles..Free

Iceland:
Cars, trucks and motorcycles, per 100 lb..... $0.22

Germany:
Motorcycles:
110 lb. or under, per 100 lb.. 16.22
Over 110 lb. to 220 lb., per 100 lb. 12.97
Over 220 lb. to 550 lb., per 100 lb. 9.72
Automobiles:
Over 550 lb., but not over 1100 lb., per 100 lb..... 6.48
Over 1100 lb., but not over 2200 lb., per 100 lb..... 4.32
Over 2200 lb., per 100 lb..... 2.16
When duties are paid in paper there is a surtax of 900%.

Greece:
Motorcycles .....$11.58 each
Motor vehicles: Trucks and omnibuses, per 100 lb..... 2.31
Passenger cars:
1320 lb. or under, per 100 lb. 6.23
Over 1320 lb., per 100 lb..... 7.91
Chassis, with or without motors or motors separate, per 100 lb. 1.26
Bodies for trucks, per 100 lb.. 11.07
Bodies for omnibuses and passenger cars .....154.40 each

Hungary:
Automobiles, chassis and motorcycles:
880 lb. and under, per 100 lb. 13.81
Over 880 lb. to 3960 lb., per 100 lb. 11.04
Over 3960 lb. to 7040 lb., per 100 lb. 9.22
Over 7040 lb., per 100 lb.... 5.49
These duties are paid in paper and should be multiplied by 20.

Italy:
Motorcycles ..... 15.44 each
Cars and trucks weighing:
Not more than 880 lb., per 100 lb. 10.53
Over 880 lb. up to 1980 lb., per 100 lb. 10.04
Over 1980 lb. up to 3520 lb., per 100 lb. 5.68
Over 3520 lb. up to 5500 lb., per 100 lb..... 6.54
Over 5500 lb. up to 8800 lb., per 100 lb..... 8.31
Over 8800 lb., per 100 lb..... 5.22
Automobiles with or without bodies weighing not more than 5500 lb. will also pay a surtax of 35% A.V. Duties paid in paper are to be multiplied by 3.

Jugo Slavia:
Cars, motorcycles and parts....30% A.V.
Trucks .....20% A.V.
There is a 10% surtax on luxuries.

Netherlands:
Cars, trucks and motorcycles.. 5% A.V.

Norway:
Motorcycles (motors are dutiable separately), per 100 lbs..$487.22
Automobiles of all kinds including motorcycle side cars.....18% A.V.
Motors, including motorcycle motors .....15% A.V.

Portugal:
Cars and trucks complete.....$129.60 each
Cars and trucks incomplete, with motor ..... 75.60 each
Motorcycles ..... 54.00 each
Surtaxes:
Cars complete:
Up to 18 hp..... 540.00 each
Over 18 hp.....1,080.00 each
Cars incomplete:
Up to 18 hp..... 270.00 each
Over 18 hp..... 756.00 each
Incomplete bodies ..... 334.80 each
Trucks—Complete or not.... 129.60 each
Motorcycles ..... 54.00 each
Import duties and surtaxes in Portugal are payable in English exchange, one-half being converted at normal rate and one-half at current exchange rate.

Roumania:
Cars, trucks and motorcycles, weighing each:
Less than 220 lb., per 100 lb. 7.63
From 220 to 550 lb., per 100 lb. 6.36
From 550 to 1100 lb., per 100 lb. 5.08
From 1100 to 2200 lb., per 100 lb. 3.81
Over 2200 lb., per 100 lb..... 2.54
These duties are to be increased five times.

Spain:
Motorcycles and parts (including motors) per 100 lb..... 78.62
Chassis, with or without motor weighing, net:
Not over 2200 lb., per 100 lb. 26.31
More than 2200 lb., per 100 lb. 31.54
Cars—with or without motors in addition to the duty on chassis:
Open .....$115.80 each
Closed ..... 185.28 each
Trucks, per 100 lb. $13.13
(A new tariff is to be issued at an early date.)

Sweden:
Motorcycles (complete) .....$16.08 each
Vehicles with or without motor, chassis wheels with rubber tires for such vehicles .....15% A.V.

Switzerland:
Motorcycles—not covered with leather or upholstered, per 100 lb. $4.36
Motor vehicles, including chassis, bodies, axles with driving gears, and radiators, not covered with leather or upholstered, per 100 lb. $3.49
Same, covered with leather or upholstered, per 100 lb. $6.98
Motor vehicles, covered with leather or upholstered, per 100 lb. $5.22

Turkey:
Cars, Trucks and Motorcycles.11% A.V.

United Kingdom:
Motor Cars and Motorcycles and Parts:
General tariff .....33⅓% A.V.
Preferential ..... ⅔ of full rate
(In calculating the value, the value of the tires is deducted from total value.)

NOTES

*The "actual duties" include 2% gold surtax and increase due to proportion of duty payable on a gold basis. The calculations are based on a value of 14 cents to the paper milries and are subject to change in accordance with variations in its value.

**Surtax included in each case where a surtax is imposed unless otherwise noted.

Gas and Electric Welding

THE welding of steel, cast iron, aluminum and other metals has become an important factor in industry during the past two decades. Both in the manufacture of machinery and in the repair of breaks much welding is done. There are two general processes of machine welding—the gas flame method and the electric method. Under each of these heads there are a number of distinct processes differing considerably in their details and adaptability. In industrial work where welding of this kind is to be used it is well to make a thorough study of the different methods available to see which one lends itself best to the work in hand. Such a study will be facilitated in the future by two books just issued by the McGraw-Hill Book Co. dealing with Gas Torch and Thermit Welding and Electric Welding respectively. The author is Ethan Viall, formerly editor of *American Machinist*.

Mr. Viall deals with the different gases used in gas welding, namely, acetylene, Blaugas, coal gas, Drigas, hydrogen and thermalene, giving their flame temperatures, ignition temperatures and other physical properties affecting their value as welding fuels. He outlines the field of gas torch welding and cutting, stating that the welding process is used in automobile and airplane construction, in lead burning and in sheet metal work, such as the manufacture of light air tanks, tubing and oil storage tanks. In aircraft manufacture gas welding is used for welding water jackets to the cylinder, valve cages to the cylinder, flanges to manifold connections, of manifolds, spark plug thimbles, tubular frame sections, splice plates, sockets to frame, aluminum crankcases and water tank. In automobile manufacture it is used for welding rear axle housings, defective gears and pinions, manifolds, shafts, steering posts, automobile bodies, tubing used in windshields, crankcases, transmission cases, wheels which are made of stamped-out parts, mufflers, valve stems to valves, rims, repairing crank shafts and frames and extending the frame to convert passenger cars into commercial vehicles.

In the book on gas welding are described the different methods of producing oxygen and the manner of its delivery to the trade, acetylene welding outfits and welding methods. The last part of this book deals with the Goldschmidt Thermit process of welding.

The book on Electric Welding deals in a similar manner with that subject. All methods are divided into two classes—arc welding and resistance welding.

What Do You Know About Your Factory Doctor?

The necessity for a careful selection of industrial physicians is emphasized by Major Magnuson of the Surgeon General's Office. Major Magnuson is associated with the Illinois Industrial Board and is thoroughly familiar with the various phases of medical work in industrial plants.

SEVERAL years ago there was a young man practicing dentistry in a Pennsylvania mining town. He had prepared at a second-rate dental school and had failed three times to pass the examinations necessary to obtain his State certificate. He had many friends in the town, however, and for several years was able to practice, in spite of his lack of license, and to elude the law through the support of his following and political friends.

This man, an incompetent dentist, obtained a position as assistant to the chief physician at one of the largest shipbuilding plants in America, held that position throughout the war and still holds it. He acted in the capacity of a medical man, not of a dentist. He started at $25 per week but has been greatly advanced.

The work of this pseudo-physician was unsatisfactory to the employees almost from the start, and later the suspicion got out that he was not a medical doctor at all but a dentist. Not only did the medical work suffer, but the reputation of the plant among outsiders was seriously affected by it. Had it not been for the excellent ability of the chief physician things might have been in bad shape.

This failure of employers to investigate carefully the qualifications of the men whom they employ as plant physicians is forcefully brought out by Major P. B. Magnuson, of the Surgeon General's Office of the War Department, in an address to the International Association of Industrial Accident Boards and Commissions.

"I don't know," Major Magnuson said in part, "how much the layman is expected to know about the different classifications of medical schools in this country. We have a number of classifications under the American Medical Association, the A-plus school—standing the highest—and the A, B-plus and the B, and these are rated according to their faculty, their equipment, their clinical facilities. Now, it makes a good deal of difference to a man in his education as to what sort of contact he has had during his student days—in the formative period. A man who has gone to one of the schools that we have in Chicago, which we call the "mill" and which the State Board of Licensors has been trying to put out of business for a good while, is not apt to have very high ideals when he comes out of school. He gets a job, usually, as a night surgeon at some large plant to help himself through school, and when he comes out, instead of taking an internship, he goes right into industrial work nine times out of ten.

"Why does he go into industrial work? Principally because, to the average corporation, the doctor is a doctor. The president of that corporation wouldn't take that man on as his own family physician, but it never occurs to him that a cheap doctor is an expensive proposition.

"I would like to tell something that happened to me when I first went into industrial work. I had been with Doctor Murphy of Chicago for several years as his assistant, and upon his advice went over to the stockyards —along Halstead Street—to get a little more experience. I went in to see the president of one of the large corporations and asked him if he didn't want a doctor.

"'No,' he said, 'We have one doctor; we don't need any more.'

"I said, 'How much do you pay him?'

"He said, 'I don't know, but I will find out;' so he called up the claim agent. They were paying the doctor $75 a month. They were being cheated, I think.

"He said, 'What do you want to do it for?'

"I said, 'I want to do it on a fee basis.'

"He said, 'How much will that cost?'

"I said, 'It will cost you $2 for the first office visit and $1 for every other one after that; $3 for the first call and $2 for every one after that.'

"He said, 'That will run over $75 a month.'

"I said, 'I hope so, or I don't want the job.'

"After thinking it over—I had quite a conversation with him—I asked him if he knew anything about his doctor. I said, 'Where did he graduate from?'

"He said, 'I don't know.'

"'What experience did he have before he came to you?'

"'I don't know.'

"I said, 'Do you know who he is?'

"'Well,' he said, 'I know his name is so and so.'

"'Well,' I said, 'Do you think it would save you any money if you had surgical treatment which was a little better than you are getting now?'

"He said, 'I don't know, but I am willing to gamble with you. I will pay you on a fee basis and I will let the other fellow stay here and pay him a salary, and the fellow that has the most business at the end of three months I will let have the job.' He added, 'You are starting out with a handicap, because the boys know this other fellow and they don't know you.'

"I said, 'Maybe that is no handicap; that may be an advantage.'

"So we went to it. At the end of three months I am glad to say I had about 80 per cent of the business. At the end of six months the bill for that one company, on a fee basis, totaled more than $600—the same work the other fellow was doing for $75.

"At the end of the year this was the record: We had had almost ten per cent more accidents than we had had the year before; we had had only one

lawsuit filed, as against thirty-one the year before. There was a total saving of $20,000 in the claim department, and the surgical department expense had been boosted almost $900.

"The training of a surgeon should be brought to the attention of an employer as much as the training of his general manager.

"He should look into the training of the surgeon he employs and the man's character as carefully as he does the general manager's, because it pays in dollars and cents, and, if we are going to talk to a corporation head, we have got to talk in dollars and cents and not in medical ethics, because he isn't interested in medical ethics; he is interested in dollars and cents saving at the end of the year.

"The weighing of medical testimony as it comes before the industrial board from the men who have examined a case and had it under observation is sometimes a rather difficult thing.

"We have tried, in Illinois, to put ourselves in a position so that the employers and employees would have enough confidence in the medical department and the industrial commission to eliminate all expert testimony; to send their case to the commission and to say, 'You tell us how much this thing is worth in dollars and cents.'

"We would like to be able to talk in dollars and cents to the employer and to show him the difference saved in compensation by the supplying of expert surgical treatment and poor surgical treatment; and, to that end, I have a rough surgical report to be filled in by the commission on every case, in order to trace our accident cases down and find out what the dollars and cents saving is per case in certain classes of injuries occurring in industry.

"If we get that information we can say to a company, 'Last year cases treated by men who rate as class A-1 men cost in compensation $350 for certain classes of injuries, on an average. Cases treated by class B men cost $850 per case. The medical treatment paid for class A men cost $75 more per case than the medical treatment paid class B men. Therefore, you have a saving of $400 or $500 per case.'"

S. A. E. Summer Meeting Program Nearing Completion

PLANS for the semi-annual meeting of the Society of Automotive Engineers to be held at West Baden, Ind., May 24 to 28, are nearing completion. Of the technical sessions at this meeting the Research and Fuel Sessions will undoubtedly rank first in point of general interest. Although the visit of Sir Dugald Clerk, the noted British scientist, has been canceled because of illness in his family, his paper will be read and discussed at the Research Session. In this session will also be included a paper by C. W. Stratford of the Associated Oil Company on automotive engine and vehicle lubrication as well as a description by Professor W. E. Lay of the new research laboratory at the University of Michigan to be used in connection with their newly established Bureau of Research Investigation. The paper by Dr. H. C. Dickinson at the Fuel Session will discuss fundamentals affecting passenger car economy. Fred C. Ziesenheim of the Carnegie Institute of Technology will present at this session a paper on the Development of a High-Compression Oil Engine for Automotive Purposes and a description of a new manifold for the Dorris car will be the subject of the paper by George P. Dorris.

Other technical sessions will be devoted to aeronautics, farm power, highway transport and engineering relation to sales. V. E. Clark's paper scheduled for the Aeronautic Session will discuss the economic reasons for the present unsatisfactory status of commercial aviation and contain suggestions of possible remedies. S. H. Philbin will emphasize the necessity of adequate Federal legislation to secure the support of the substantial business man for air transportation. G. J. Mead's paper will criticize the present practice of powerplant installation in aircraft and point the way to probable future development.

The tractor testing work and operation study at Purdue University will be the basis of a paper by Professor G. A. Young. The United States Department of Agriculture has recently spent several months making a survey of the farm tractor under varied conditions, and H. R. Tolley, who has been engaged in this work, will present data resulting from these investigations. It is planned to have the recent progress of the Government highway research work described at the Highway Session. The Economic Status of the Automotive Industry is the title of a timely paper to be read by F. R. Pleasonton at the Engineering Sales-Stimulus Session, stressing the importance of economy of operation in future car designs.

The sports program this year will be one of the most comprehensive ever conducted by the Society, including everything from a tug-of-war to croquet, with appropriate prizes. Golf, tennis and trapshooting tournaments are planned, as well as two baseball series. The ladies will find card parties, clock-golf, croquet and tennis tournaments arranged for them, not to mention the dancing contest that has proved so popular at past meetings.

The reduced-fare plan which has been arranged with the railroads differs from the one in effect at the annual meeting last January. A reduced-fare certificate will be mailed by the Society to its members about May 1. This must be presented when transportation to West Baden is purchased in order to secure a 25 per cent reduction. Round-trip tickets only may be purchased under this plan; no stop-overs are allowed and the same route must be used in both the trip to West Baden and return. A map, which will be mailed with the certificates, will show the area in which this reduced-fare plan applies.

While the meeting at West Baden will open with a session of the Standards Committee on Tuesday, May 24, it is planned to hold a joint session with the American Society of Mechanical Engineers at McCook Field, Dayton, Ohio, on the preceding Saturday, May 21, at which time the members of the two societies are to be the guests of the Air Service. Opportunity will be given for inspection of the Air Service laboratories and flying equipment at McCook Field, and special arrangements for exhibition flights are being made. The session at McCook Field will include a talk by Major Thurman H. Bane on the Future of the Air Service, to be accompanied by motion pictures of aircraft and aeronautic devices in operation.

On Saturday evening the Dayton Section of the S. A. E. will entertain members of the S. A. E. and A. S. M. E. at the Dayton Engineers' Club, the functions including a dinner at 6:30, to be followed by a ball to which members and their wives are invited. C. F. Kettering will make an address at the dinner.

"Bunk" or a Fair Deal? A Discussion of Mental Attitudes

Mr. Tipper discusses how honest attempts at fair dealing by the manufacturer may be regarded as "bunk" by the worker. The worker's point of view must be recognized when information is being presented to him. Ignorance may bring as bad results as deliberate deception.

By Harry Tipper

THE men were filing out of the plant after the day's work and receiving their pay at the pay office on their way out. As each man received his envelope, attached to it was a larger envelope evidently containing some kind of a notice from the concern.

A little group of men who had received their pay were engaged in counting it up and perhaps speculating upon the contents of the other envelope which no one had opened up to that time.

Another man came up to the group with his envelopes in his hand.

"Say, fellows," he said, "what's the dope?"

"Some more bunk from the old man; suppose we might just as well see what it is, any way."

After the man had left the group to go home the old man caught up with him.

"Look here, Bill; I heard you say you supposed this was more bunk. Is that what you really think about it?"

"Why, sure. When you've worked in as many places as I have you will find out that just so much of the stuff they hand you is bunk, pure bunk, that you don't pay any attention to anything they say."

"Well, now," returned the old man, "that's all right, Bill; but you have been here about four months and you have had time to find out what is happening in this shop. Have you found us giving you any bunk?"

The man thought a minute.

"No, now that I think about it, I guess I have not. Everything you handed me has meant something and you stood by it. I guess I got into the habit of thinking everything was bunk, and had not figured out the difference."

"That's fine, Bill," returned the old man, "I am glad to hear that; now if we have been on the square with you you should have been on the square with us. You have some influence with some of these other fellows, and it makes them suspicious when they hear you talking about the bunk we are handing out. Don't you think it would be only fair to let them know what you have found out?"

It was a custom of the old man to stick around the pay office once in a while after the shop was closed, and get next to the man who had a grievance or who indicated that he had a suspicion of the treatment he was getting. It had paid. The family spirit had continued in the organization even when it had grown large enough to employ two or three thousand men and conducted a business big enough to occupy the full time of any leader.

Bill's remark about the bunk illustrates a point of view which is quite prevalent among intelligent workers, and the man who is sincerely endeavoring to be square with his employees suffers from this condition. Even his own executives in their attempt to be fair and to give the worker a proper knowledge of the organization, are likely to address employees through factory house organs or bulletins or in other ways, in inspirational talks, things which look like preachments. They don't appeal to him, the worker, and are classified as mere bunk.

In many establishments the same care for the individual human relations is not evident, and in such establishments the methods employed to communicate from the management to the worker are irritating to him and the methods of expression destroy the interest that might be established or throw doubt on the sincerity of the information itself.

The men talk freely among themselves about these things. They are inclined to suspect the motives of the management and they get into the habit of regarding most of the material from the management as meaningless or as an attempt to put something over.

No man likes to feel that his point of view has been entirely neglected by the boss; every man has some sense of his own worth and some self respect. Every man expects an acknowledgment of his individuality and his individual interest.

A man must be a pretty close friend before we will permit him to preach to us about what we should do or advise us as to our mistakes without resenting it. That is particularly the case where business obliges us to work together and to conceal our resentment to some extent.

A good many of the attempts to establish understanding within the factories have developed into the definite development of propaganda to the men, instead of working out any discussions with them. Many factory house organs published by the management have turned out more copy about the company, its strength and its facilities, the high character of its organization and so forth, than they have about the practical difficulties of the shop and the practical necessities of the workers.

Some house organs in their editorial approach to the worker remind me very much of the politician to whom the colored voter had been listening for a considerable time as he expounded his platform. Afterward the colored man was asked what he thought of the candidate, to which he replied: "He certainly do recommend himself most highly."

A good deal of the material sent from the management to the workers, supposedly for the purpose of establish-

ing the co-operative or family spirit in the organization, is so definitely a high recommendation for the concern that it cannot fail to evoke a similar but stronger comment from the worker who reads it.

The unfortunate part of the matter is the influence exercised upon the attitude of the worker by these experiences. Labor turnover is considerable in most industries; even the skilled workers float from job to job. There is considerable free masonry among men of the same occupation, and the comments arising out of some of these experiences are carried far and wide beyond the area of the establishment in which they exist.

Very few men, even those who are writing to the factory workers through house organs or other contacts between the management and the workers, get out among the men so that they can study the attitude of the worker and his reactions to his own work. This cannot be done by simply going among the men in the shop; the freedom of their conversation is lost as soon as a stranger gets into it and the man who sees his workers only when he is in his official capacity will not get their full reaction unless he has been able to prove by patient acquaintanceship with them, that he respects their confidence and their individual point of view. It is very easy to lose the atmosphere in which influence is created and through which differences are erected when the circumstances of the work removes one from the continual pressure of that atmosphere.

Some years ago I had occasion to write some advertising relating particularly to conditions in the State of Texas. I spent a month in Texas at that time and had been in that State a number of times before. The first pieces of advertising were written while I was in Texas. After I had been back about three months in New York it was necessary to write more of the advertising to continue the campaign. I found it impossible to duplicate the work which had been done in Texas, even though conditions were fairly fresh in my memory, because the suggestion arising out of the pressure of the atmosphere was lost.

Unless we constantly refresh ourselves by contact with various kinds of people, we lose the understanding of their attitude and the reason for their influence. When we do that our attempts to interest them must appear absurd and of little value. A lot of the things which appeal to the worker as bunk are sincere efforts to improve his understanding of business, his capacity as a worker and the co-operative spirit of the plant.

They fail not from lack of sincerity but from ignorance of the man to whom they are addressed. Of course there are many plants where there is no attempt to understand the worker at all, and these plants are always sources of possible dissatisfaction and trouble. Ignorance is responsible for more misunderstanding than the deliberate attempt to deceive, but well-meaning ignorance will be just as certain in its results as the deception created by the deliberate desire.

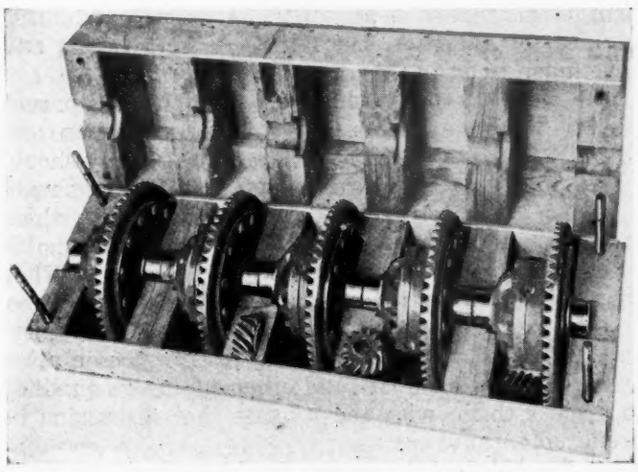
It is worth while that every approach to the factory worker should be carefully considered from his standpoint, so that the things which he should understand are understood in their proper relation.

New Type Returnable Container for Differentials

A NEW type of returnable container suitable for use in shipping five differentials has been developed by the Forest Products Laboratory of the U. S. Department of Agriculture. The new container was perfected after two experimental types had failed to withstand the severe test to which the boxes were subjected.

This new container is not only so constructed as to prevent damage or breakage of any kind, but also protects the differentials from dirt, dust and moisture. The construction of this crate was as follows.

Longitudinals—1¾ x 1¾ x 36 in., Southern yellow pine. Spacing blocks—2⅝ x 3⅝ x 10¾ in., Southern yellow pine. The longitudinals are nailed to spacers with 2-16d cc. box nails at each intersection. Bolts at the four corners are ½ x 11-in. machine bolts. A covering of 3/16-in. 3-ply birch is used.



Returnable shipping container for differentials

Three-ply material is used for covering because it is much more durable under rough handling than single-ply material. Practically any species can be used in this wood covering, but hardwoods, such as black ash, soft or silver maple, red gum, sycamore, white elm, hickory, beech, birch, oak, white ash, or rock elm, are preferable.

Four pieces of a 4½ x 36-in. size, and two pieces, size 9 x 32 in., are required to cover the crate.

The cover is nailed on with large headed nails. Sixpenny cement coated box nails are best to use with plywood of the hardwood groups, but special large head nails are advisable if any of the softer woods are used.

This crate was developed by the Forest Products Laboratory at the request of a large manufacturer of differentials, and can be built as described at a cost of about $3. A similar crate, built along slightly modified lines, can be made at a cost of about $1.75, although this latter type is possibly somewhat less efficient than crate described.

TESTS are being carried out by the Bureau of Standards on special blended fuels at the request of other government departments. Conferences have been held with members of the Fuel Research Committee of the S. A. E. and other organizations, including representatives of the government, looking toward the formation of a definite program for the investigation of various fuel problems of interest in connection with automotive engineering practice. During a recent visit of one of the members of the Bureau's staff to Europe a special study was made of fuel conditions abroad.

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Industrial Investigations

ANNOUNCEMENT is made from Washington that President Harding has asked that Congress initiate a movement to inquire into the methods of a number of industrial associations. The idea behind this movement appears to be that the Federal Trade Commission believes that a number of industrial associations are given to price fixing. It is not the idea that these associations actually fix prices for their members, but the members exchange such price information as leads to practically uniform prices on similar products. The rather informal method of reaching a uniformity of price is called the "open price system."

The idea developed by the Federal Trade Commission, and furthered by President Harding, is that these lines of business must be brought to a competitive basis. Most of the industries involved are basic from a cost of living standpoint. They include coal, sugar, lumber, petroleum and similar articles.

The industrial organizations of the automotive industry are not included in this list. It perhaps is somewhat unfortunate that our organizations are not to be investigated, considering what one hears in some quarters. There are persons who cannot see any use for an industrial organization unless it is to fix prices. We believe that the automotive organizations have a much worthier objective than this, and that it would be little trouble to prove this objective in any inquiry that Congress might authorize. While an inquiry of an organization or an industry is not desirable ordinarily, it is sometimes worth while as an opportunity to show clean hands.

The industrial organizations named as likely to be investigated are perhaps to be envied by some others against whom the tongue of scandal has been turned. An opportunity to answer a false charge should always be welcomed.

Better Papers Needed at S. A. E. Section Meetings

MANY of the papers presented at meetings of the Sections of the Society of Automotive Engineers are excellent engineering treatments of the subjects considered, but it happens quite frequently that Section meetings are given over to papers and discussion which center around some single commercial device which the author of the paper is desirous of exploiting in engineering circles. Such papers are no credit either to the Society, the Section or the author. They are, in fact, a liability, for they lay the Society and the Section open to the criticism of allowing itself to be used for commercial rather than strictly engineering purposes, and they leave a bad taste in the mouth of the engineer who attends the meeting in expectation of hearing a genuine engineering discussion and is disappointed when he hears a sales talk, of which he gets a plenty through legitimate channels.

Few things can do a professional society greater injury. It is a thing which every engineering society must continually watch. Engineering ethics condemn it, yet men who call themselves engineers not infrequently "put over" papers open to criticism in this regard. Fortunately, the S. A. E. (the parent Society) has for many years been at least as free from criticism in this regard as any of the large, well organized engineering societies, but the S. A. E. Sections still have much to do in this direction.

The same methods which are used by the parent Society to prevent abuse in this direction can and should be used by the Sections, and the Society should insist upon this being done. Section papers should be requested long in advance of the meeting at which they are presumably to be used, subject to reasonable rules in regard to their acceptance and use. They should then be passed upon by a papers committee, and if acceptable be printed, at least in abstract form, and circulated prior to the date set for presentation among Section members and other engineers qualified to discuss them, with the request that discussion be prepared in advance.

At the meeting the paper should preferably not be presented in full, if printed and distributed in ad-

vance. An outline should be given, and the paper then be thrown open to discussion. Engineers naturally hesitate to discuss a paper which they have not had an opportunity to digest but will gladly do so if given an opportunity to study it. The primary idea of an engineering meeting is to bring on an interchange of ideas, and a meeting in which the discussion is meager and ill considered fails in its main purpose.

Discussion can be controlled to a considerable degree by the chairman, especially if he knows the subject and is as familiar with the paper as he should be. Discussions should be held strictly to the subject and not revert, as it often does, to some more or less irrelevant topic raised by someone in the audience.

Importance of Foreign Trade

FOREIGN trade is to be an important topic at two national business organization meetings which will be held in the very near future. The first is the meeting of the Chamber of Commerce of the United States at Atlantic City next week and the next the Foreign Trade Convention at Cleveland, the week following. It is interesting to note that in both of these conventions the importance of foreign trade to the industrial welfare of this country is the big thought. Also it is interesting to note the attention given to the leaders in automotive export trade in the formation of these programs. Practically all industries in this country are recognizing the importance of the automotive industry as a leader in export affairs.

Recent announcements of the development of the program of the Chamber of Commerce of the United States call particular attention to the group meeting on taxation. One of the chief speakers at this group meeting will be C. C. Hanch, chairman of the Taxation Committee of the National Automobile Chamber of Commerce. Mr. Hanch will present the N. A. C. C. tax program which has been attracting so much attention.

Economics of Tractor Plowing

THE remark has often been made that a farmer purchasing a tractor does not do so, as a rule, because of an expected gain in economy, but because he wants to farm a greater acreage without any additional help or because he wants to be able to get his crops into the ground in time in spite of unfavorable weather. While this statement is undoubtedly true, yet it cannot be denied that many more farmers would buy tractors if they felt certain that by doing so they could reduce their operating costs. Farming in this respect is very similar to manufacturing. Operations on a larger scale permit of increased profits, but a reduction in operating costs allows of an increased profit on the same turnover.

The three largest items of cost in tractor operation are labor, depreciation and fuel. Repairs and interest on investment are smaller items, while the cost of lubricant is rather unsettled. All of these items of cost when reduced to a basis of acreage plowed depend upon various conditions. The labor charge comes especially high in the case of a small tractor. Theoretically it should cost twice as much for labor per acre if the work is done with a two-plow tractor as when it is done with a four-plow tractor. In practice the difference is not quite so great because the small tractors usually operate at somewhat higher speed. The way costs run at present, labor is easily the largest item in plowing cost with a two-plow tractor burning kerosene, whereas with a four-plow tractor fuel is the main item.

This would point to the desirability of increasing the capacity of tractors. However, farms are usually either one-man, two-men or three-men farms; that is, they are of such size that the number of men indicated can do all the necessary work. A larger tractor might save a few days' work in plowing, but would not permit of dispensing of the services of one man and hence would be of little added advantage to the farmer. The only way that the greater capacity of the larger tractor can be taken advantage of is to increase the acreage under cultivation, and this is what frequently happens when a farmer buys a tractor or substitutes a larger tractor for a smaller one. The fact is that the labor supply on the farm is not very flexible and in order to take advantage of labor-saving machinery the easiest way is to increase the scale of operation.

Interpreting Failure

THE proper handling of industrial relationships is a definite aid to reducing costs and increasing production, both as to quality and quantity. Only upon this basis should any labor policy or plan be based; and upon this basis it should be judged. When it is regarded in any other way, it will not be beneficial to either employer or employee, viewed over any considerable period of time.

Until such a conception becomes more widespread, there are likely to be additions to the already long list of ineffective labor policies. When an industrial relations plan is put in as a sop to the worker, lacking any more fundamental purpose, it will fail. But such failures do not indicate that an everlasting battle constitutes the only possible future. They do indicate that sufficient study of the problem has not yet been made to enable us to devise really effective plans.

Spread the Good News

PRESIDENT CLIFTON of the National Automobile Chamber of Commerce has suggested that every car and truck manufacturer shall print on his letterhead this quotation from the President's message:

> The motor car has become an indispensable instrument in our political, social and industrial life.—President Harding.

This is such an excellent suggestion that its promotion should not stop with the manufacturers but should extend to all persons whose chief business is with the automotive industry.

Collins to Head Durant Subsidiary

Cadillac President Soon to Quit Post

Will Resign from General Motors to Direct Durant Manufacturing in Michigan

NEW YORK, April 18—R. H. Collins will resign as president and general manager of the Cadillac Motor Car Co. to associate himself with W. C. Durant in the development of Durant Motors, Inc. He will head the Durant subsidiary company in Michigan which may be known as the Durant-Collins Co. In this capacity he will be in charge of the chief manufacturing activities of Durant Motors, which will be centralized in the Detroit district. The main factory will be located either in Detroit or Flint. Collins is said to be in favor of locating in the former city.

The addition of Collins to the Durant organization is regarded as a strong acquisition. He will have much to say regarding the development of the Durant line and it is thought probable that in addition to the Durant "four" there also will be a Collins car.

Collins has been intimately associated with Durant for years, having joined him in the old Durant-Dort Carriage Co. at Flint in 1907. After remaining there 3½ years he went to the Buick Motor Co. as sales manager. When Durant regained control of the General Motors Corp. after it was taken out of his hands by a bankers' committee, he brought Collins on to New York as his assistant.

Collins remained in this city until Henry M. Leland resigned as president of the Cadillac company in 1917. He then took charge of the Cadillac operations and has conducted them successfully ever since that time. He is credited with having had much to do with building up the reputation for sterling worth which the Cadillac line now enjoys. His most recent announcement in regard to that company was that there would be no change in prices for the remainder of this year at least.

The formal resignation of Collins has not been submitted to President duPont of General Motors but he will retire in a short time and take up active direction of the affairs of Durant Motors in Michigan. Formal denial of the resignation was made by General Motors and also by Collins.

QUASH TEMPLAR SUIT SUMMONS

COLUMBUS, April 16—Service of summons in the receivership suit filed by S. B. Clyburn against the Templar Motor Car Co. of Cleveland in the Columbus courts has been quashed upon orders of Judge Sowers. The suit was also filed against the Templar Fiscal Co. and W. O. Cooper. President Bramley of the company was served while in the State capitol and this was fought on the grounds of illegality. The court held that the service on the president, who is a co-defendant, is legal but that the corporation must be served in Cuyahoga county, which is now being done by the plaintiff. It is expected to have the case finally decided by a commissioner.

Milwaukee Parts Plants Speed to Meet Demand

MILWAUKEE, April 18—Further extension of operating schedules and the steady addition of men to working forces is a feature of the situation in the automotive parts and equipment industries of Milwaukee. The A. O. Smith Co., for instance, which was virtually down on Feb. 1, is now employing more than 1200 operatives, and re-employing more almost daily. This is due to the revival of demand for pressed steel frames, forgings and pressed steel parts for passenger cars as well as trucks.

Makers of ignition apparatus and similar specialties, likewise are enlarging the scope of operations as a reflection of brisk activity in the retail trade which gradually is crowding dealers and in turn the manufacturers. The scale of factory wages is now about 20 per cent lower, on a broad average, than on Jan. 1.

The revival of demand for passenger cars in the last two weeks has been astonishingly good, and while in ordinary years this was to be expected with the progress of spring, nevertheless the extent to which business has expanded is considerably greater than the most enthusiastic dealers had looked for earlier.

HARDING RENOMINATES BAIN

WASHINGTON, April 18—President Harding last Saturday sent to the Senate the name of H. Foster Bain for renomination as director of the Bureau of Mines. It is believed that the appointment will be confirmed. There had been reports current that the Secretary of the Interior might send in the name of another for the position, though recognizing the ability and services of Bain, who had taken the appointment under President Wilson as a duty rather than through any personal desire.

AIR MAIL HELPS COAST TRADE

ROCKFORD, ILL., April 18—The Fyrac Mfg. Co., makers of spark plugs, has brought its San Francisco office one day nearer the factory by making use of the air mail service.

Government Suggests New Tire Standards

Rubber Association Gets Copy of Tentative Specifications for Further Revision

WASHINGTON, April 19—Ways and means for revising government tire specifications with a view to adopting better standards were discussed at a meeting at the Bureau of Standards this week. Specifications for tires which the Bureau had prepared were submitted to the committee present, comprised of tire manufacturers and representatives of the Government and of the District of Columbia, and the various members suggested such changes as seemed desirable.

The committee decided to send a copy of the specifications together with these recommended changes to the Rubber Association of America for its consideration and possible further revision. The specifications and the resulting changes are then to be returned to the Bureau of Standards when a second meeting will be called for further consideration of the problem. When completed, these specifications for tires, the Bureau has announced, will be available to the various branches of the Government, to municipalities, and to private corporations who buy tires in quantity.

The Motor Transport Corps, as a large user of automobile tires, it was stated, is particularly interested in the question of tire specifications, and it assisted by sending announcements of the meeting to the various tire makers. Representatives of the different companies were especially requested to be present and in addition the Government was represented as follows: War, Navy, Treasury, Agriculture, Interior, Postoffice, and Commerce Departments, the Panama Canal, Shipping Board, Compensation Commission, and the Commissioners of the District of Columbia.

OHIO GETS ROAD ASSURANCES

CLEVELAND, April 18—Ohio hereafter is not going to build roads that start nowhere and get nowhere, Fred H. Caley, secretary of the Cleveland Automobile Club, declared at the annual meeting of the organization. "Our club officers have been assured that State and Federal funds are to be systematically expended in the construction of main highways and intercounty roads," he declared. He spoke of the increase in the rates of insurance on theft of cars that had been imposed in the last thirty days and scored leniency in dealing with automobile thieves.

Governor Raps Reserve Bank Action

Harding to Take Up Kansas City Policy

No Instructions Ever Issued to Ban Car Paper—Reserves Show Big Gains

WASHINGTON, April 18—A personal investigation into the relations between the Kansas City Federal Reserve Bank and the automobile industry will be made by Governor W. P. G. Harding of the Federal Reserve Board, as a result of a conference here to-day between the governor and C. A. Vane, general counsel of the National Automobile Dealers Association.

Governor Harding promised Vane that he would visit Kansas City, May 21, and at that time he would take up with the directors of the Kansas City bank the question of policies that have been pursued toward the automobile trade in that district and that he would additionally give a committee from the Kansas City Automobile Dealers Association, which is affiliated with the N. A. D. A., an opportunity of presenting their side of the case. Vane immediately wired E. E. Peake, secretary of the Kansas City association, to get his committee and his information together for the hearing.

At Vane's request, Governor Harding also agreed to address a gathering of representative Kansas City business men, bankers, merchants, automobile dealers and the like, and give a talk on business, economic and financial conditions in Kansas City, Saturday night, May 21. Peake will have complete charge of the arrangements for this meeting.

Decision Rests With Bank

Governor Harding displayed intense interest in the Kansas City district situation. As the result of information given him by Vane, the Governor said that he would tell the bankers of the State of Kansas in a speech he will make at Topeka, May 20, that if they refuse to extend credit to the automobile business or to any other business that they should admit that such refusal is a result of their own decision and not be so cowardly as to hide behind the declaration that they were acting upon instructions from the Federal Reserve Banks or the Federal Reserve Board.

"No such orders ever have been issued," the Governor said. "Commercial paper is either eligible for rediscount or it isn't eligible. We never have ruled against automobile dealer paper. Under no circumstances could we order a discrimination against paper which is legally eligible. Either the member bank will accept it or refuse it. It accepts or refuses on its own decision."

Governor Harding was asked if there had been an improvement in the general credit situation and if a further improvement could be expected. To both questions his reply was "yes." The following question was then put to him:

"If there is a general credit improvement do you know of any reason why the Federal Reserve banks should single out the automobile industry for restriction?"

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Packard Bonds Sold Out Two Hours After Offered

DETROIT, April 15—President Alvan Macauley of the Packard Motor Car Co., in announcing that the issue of $10,000,000 bonds by the company had been subscribed in less than two hours after being offered, declared it was simply proof of public confidence in the automotive industry.

The money received from the note issue will be used as working capital, and will permit of increased production, Macauley said. Packard had planned an output of 1000 single Sixes for April and at the beginning of the month was employing 3000 men. With ample financial resources production schedules will be increased rapidly, and it is expected the May output will be double that of April.

While practically all efforts of the company are being directed at production of the single Six, twin Sixes are coming through every day in small numbers. Sales demand throughout the country except in three sections which have not yet recovered from the depression, Macauley said, assures a ready market.

COLLISION RATES INCREASE

NEW YORK, April 15—Following the failure of the automobile committee of the National Workmen's Compensation Service Bureau and the National Automobile Underwriters' Conference to abolish full collision insurance, rates on this cover have been increased 60 per cent. On the $50 deductible cover (where the assured undertakes to pay all losses less than $50) the rates have risen only 40 per cent and on the $100 deductible 33 1/3 per cent.

PIERCE-ARROW AT CAPACITY

BUFFALO, April 19—The Pierce-Arrow Motor Car Co. shipped 280 passenger cars in March, and April schedules call for 300. This is approximately capacity production for the passenger car plant. Sales of motor trucks are slow.

Better Relations, Hope of Dealers

Dealers Look to Detroit Conference to Correct Evils of Present Factory Relations

MILWAUKEE, April 20—President Jesse A. Smith of the National Automobile Dealers Association, at a meeting of the Milwaukee Automobile Dealers Association, said the conference between committees of his association and the National Automobile Chamber of Commerce at Detroit on May 9 will mark the opening of a new era of factory and dealer relations.

Appointed to serve on the N. A. D. A. committee are President Smith, Milwaukee, Hudson-Essex; H. B. Harper, Philadelphia, Overland; F. W. A. Vesper, St. Louis, Buick; A. J. Shorey, Boston, Velie; P. H. Greer, Los Angeles, Maxwell-Chalmers and Hupmobile, and N. H. Cartinhour, Indianapolis, Federal truck.

The dealers believe there are eight subjects which need discussion and that revision of some of the principles of operation is necessary before the selling of automobiles can be satisfactory. In the main these are the subjects discussed at the N. A. D. A. convention in Chicago in February, and they are:

1—Contract cancellation clause.
2—Discounts.
3—Exclusive representation.
4—Used car problems.
5—Parts, discounts and stocks.
6—Service policies.
7—Advertising.
8—Freight rates.

In the correction of evils affecting the dealer, which come under these general heads, the dealer association believes much of the friction resulting from present methods of intercourse will be abolished. Fundamental policies are changed too readily by certain factories, it is felt, and these changes, declare the dealers, do not tend to increase stability in the dealer organization.

AVIATION RISKS DECLINED

NEW YORK, April 16—The association of casualty insurance companies writing health and accident insurance, known as the Bureau of Personal Accident and Health, has adopted the following provision relative to the participation by the assured in aeronautics:

"Nor shall it cover any injury, fatal or unfatal, sustained by the insured in or on any vehicle or mechanical device for aerial navigation, or in falling therefrom or therewith, or while operating or handling any such vehicle or device."

Ford Does Not Need Aid of Banks

Gets Back on Feet and Pays Back Loans

Financial Recovery in Few Weeks Remarkable—Proves Strength of Industry

NEW YORK, April 15—One of the most remarkable financial comebacks in the history of the automotive industry has been staged by Henry Ford. Only a few weeks ago financial circles in this city were asserting positively that he would have to negotiate a large loan at the banks upon the bankers' own terms but no similar prediction ever was farther from the actual facts.

Ford not only has been able to avoid asking the banks for new financing but he has just paid $25,000,000 in notes a few days before their maturity. This wipes out the bank obligations. Besides paying the bank notes standing against him, Ford has discounted his April trade acceptances and last Thursday had $8,000,000 in cash.

It is confidently believed that Ford will have ample cash to meet his trade acceptances for May, but if he is unable to clean them all up on the due dates, Detroit banks have agreed to extend him all the accommodation necessary for a brief period. In addition to meeting his bank loans and merchandise obligations, Ford paid his quarterly income tax instalment before it was due.

The marvelously rapid turnover in cash in the Ford treasury for the past two months has been due in large measure to the fact that his traffic department has worked out a plan under which deliveries which formerly took eighteen days now are made in eight days. Increased labor efficiency has made it possible to operate the plant at approximately 80 per cent of capacity with 60 per cent of the normal labor quota. Overhead costs have been cut to the bone. This process has gone so far as to discontinue some of the telephone trunk lines which ran into his factories and surplus office equipment has been sold.

Lower Material Prices Help

The prices of all materials used in the manufacture of Ford cars have been substantially reduced and this has added a substantial sum in the aggregate to the profit on car sales. These manufacturing economies were what finally turned the scales and they will permit continued large scale operations without further financing except, perhaps, for temporary loans of comparatively small sums by Detroit banks.

The detailed story of Ford's negotiations with New York bankers was told in AUTOMOTIVE INDUSTRIES several weeks ago. The facts did not coincide in any way with the stories printed with so much gusto by the financial publications which seemed to take delight in picturing him as on the verge of ruin. The only negotiations which actually were instituted were on the most friendly basis and he could have had any sum he needed on reasonable interest terms without turning over the control of his factory to bank representatives. He pulled through, however, without any assistance.

Franklin April Output Sold Out on April 9

NEW YORK, April 18 — Franklin Automobile Co. reports that the entire production for this month, totaling 940 cars, had been sold on April 9 and that in addition there remain 420 orders for April delivery which could not be filled. In the first quarter of the year Franklin sold and shipped 2546 cars.

Inventories of the Franklin company were reduced more than $1,250,000 in the first three months of 1920. This is from the peak of $11,100,000 recorded early last fall and the total reduction since that period amounts to approximately $5,000,000. Current accounts and notes payable were reduced 40 per cent in the three months period ended March 31.

In order to increase its present supply of bodies, the Franklin company has reopened its body plant which occupies 65,000 ft. of floor space and has been closed since Dec. 1. Production of bodies is expected to reach 3 a day by June 1.

GEORGIA GETS FEDERAL AID

ATLANTA, April 16—The sum of $550,477.35 has been received by the State of Georgia from the Federal aid road fund during the months of February and March to reimburse the State and counties that are constructing modern roads as a part of the State highway system. There are numerous other projects in operation with county funds or State funds alone, representing several million dollars. Many of these projects will be completed this year, the State highway department announces, giving Georgia one of the best highway systems in the South.

MICHIGAN PASSES THEFT BILL

LANSING, April 16—The Condon bill which establishes a system of abstracts governing all transactions in automobiles which was passed by both houses of the legislature was approved yesterday by Governor A. J. Groesbeck. The measure is one which was offered by the Detroit Automobile Club and other automobile interests in the effort to put a check on thefts in Michigan.

Cleveland Factories Advertise for Help

Papers Carry Ads for First Time in Months — Production Gradually Grows

CLEVELAND, April 18—The Grant Motor Car Co. has given one of the most striking demonstrations in the local field of the progress made in the production end of the automobile industry since the first of the year. The March program provided for production of 350 cars, but a flood of orders came in from all over the country and there were 450 cars made and delivered from the factory.

The schedule for April calls for 450 cars, but the volume of orders the first week in April were in excess of the number received in the same period in March. Predictions are made that the company will be forced to exceed its April schedule by from 50 to 75 cars. The company has made a practice of exceeding its production schedule each month since the first of January.

For the first time in months, help wanted ads are appearing in local newspapers over the signature of automobile companies. Manufacturers are advising former employees to get in touch with them at once, as positions are open.

The Jordan Motor Car Co. has been advertising for the return of its men to their old positions. This company has gradually increased its production each month, and April will be no exception.

The Chandler Motor Car Co. reports better business in April so far than it had during March. The same is true of Peerless, Templar, White and Cleveland. The Merit car, which just recently has been produced in this city, has encountered a nice demand, the management reporting 500 orders received.

On an average, it is estimated that local automobile factories are working on about a 50 per cent of capacity basis, with prospects favorable to a considerable increase in production in the next two or three months.

MICHELIN ADDS TWO TIRES

MILLTOWN, N. J., April 18—The Michelin Tire Co. has added two new cord sizes, a 30 x 3½ soft bead clincher and a 32 x 4. The former size fits all 30 x 3½ clincher rims and is considerably oversize, being actually 31 x 4. The price is $30. The 32 x 4 regular size cord is $37 which is only $3.50 more than the fabric tire of the same make and size. A reduction in the price of the 32 x 3½ cord from $40.70 to $37.50 has also been made. This size fits the Dodge and other cars of similar type.

Ansted Takes Over Spring-Axle Plant

Connersville Factory of Standard Parts to Make Parts for Lexington Cars

CONNERSVILLE, IND., April 18—Ansted Spring & Axle Co. has been organized under the laws of Indiana with an authorized capital of $500,000 by Frank B. Ansted, president of the United States Automotive Corp. and the Lexington Motor Co., and has taken over the property in Connersville formerly owned by the Standard Parts Co. of Cleveland.

Under the plans of the management, all springs for Lexington cars will be made in this plant and, in addition, springs will be made for other car manufacturers. When running at capacity the plant employs between 300 and 400 men and is modernly equipped throughout.

The acquisition of the spring plant is regarded as another step in the expansion of the United States Automotive Corp. and will bring under unified control and central management the making of all major parts entering into the assembly of Lexington cars.

In calling the company the Ansted Spring & Axle Co., the plant is resuming an original title. When first organized by Edward W. Ansted, father of Frank B., Arthur A. and George W. Ansted, it was called by this name until merged with other plants under the name of the Western Spring & Axle Co. Edward W. Ansted was vice-president of this company until its sale to the Standard Parts Co., just before his death in 1916.

Ansted Finds Business Coming Back Sanely

INDIANAPOLIS, April 18—Frank B. Ansted, president of the Lexington Motor Co. at Connersville, Ind., declared that "business is coming back along sane paths and through legitimate channels," in speaking at a reception given in his honor at the Connersville Country Club. "We are recovering under a sound monetary system," he said, "and although the processes of recovery must be slow, they are being furthered on safe grounds."

The occasion for Ansted's address was upon his return from a two months' tour of the West which took him to all the principal cities of the Western states and Pacific Coast. His trip was made for the purpose of studying business conditions.

KING WOULD PROBE ROADS

WASHINGTON, April 18—Senator King of Utah has introduced a resolution authorizing the appointment of a special committee to investigate Federal aid expenditures in the construction and maintenance of highways throughout the country. The Senator reflected the opinion of President Harding as expressed in his address to Congress, that there had been wastefulness in the distribution of Federal monies. It is pointed out that sums aggregating more than $266,000,000 have been expended since July, 1916.

The Commission would be authorized to conduct hearings in all sections and in places where complaints have been made of political patronage on government money.

Indiana Plants Show Increased Activity

ANDERSON, IND., April 16—Automotive industries here have shown some slight improvement in the month. The Remy electric division, General Motors Corp., is now employing about 1300 men, according to information this week. This is about 33 per cent of the normal force. The plant has been working on about 10 per cent basis for a number of months.

Laurel Motors Co. is working about half a force. It is filling motor block orders for one or two standard cars. Officials of the company assert they have sufficient business in sight to make them certain of almost normal production after May 1.

The Bull Tractor Co. is in the hands of receivers and developments are uncertain at this time.

Colonial Tire & Rubber Co. and the Quality Tire & Rubber Co. are still shut down and none of the officials reached would commit themselves to statements. Both companies are said to be in fair condition that will permit them to resume operations if the tire consumption produces a market. Inventories were liquidated some time ago.

Government Undertakes Farm Equipment Survey

WASHINGTON, April 18—The division of rural engineering of the Department of Agriculture has begun a compilation of statistics of the production and sale of farm operating equipment, a subject on which there is comparatively little information of a reliable character. No such comprehensive efforts have been undertaken heretofore. A questionnaire will be sent to all manufacturers requesting information on the number of machines manufactured, their total value, the number sold in the United States and number exported. One division of the questionnaire includes tractors and traction engines. The survey is expected to give accurate information on the relative demands of domestic and export trade.

TO OPERATE MEXICAN PLANES

TAMPICO, MEXICO, April 15—The **Eastern Mexican Aviation Co. has been formed in Tampico under the management of R. H. Maloney and will operate planes in and around this city and between Tampico and the City of Mexico, San Luis, Monterey, Vera Cruz, Tuxpam, Matamoras and other cities.**

Hart-Parr Suspends Tractor Production

Finds Conditions Unfavorable for Manufacturing—Will Clear Off Unsold Stock

CHARLES CITY, April 18—The tractor plant of the Hart-Parr Co. has suspended operations for an indefinite period. Notices posted at the plant state that it seems unwise to continue manufacturing under existing conditions with a large number of tractors on hand. Business is sound, but it is quiet at this time and buying is extremely light. The company will retain many of its superintendents and foremen who will look after the plant while it is closed. Resumption of operations is expected within the next 30 or 60 days.

Checks for their share of the profits for 1920 were distributed by the Hart-Parr company on March 18 to employees eligible under the continuity of service participation plan. This plan was announced more than a year ago to apply to those supervisional employees who had been in continuous service for two years or more prior to Jan. 1 last. Checks ranging from $10 to more than $500 were distributed. This plan is said to have resulted in much closer co-operation with the company on the part of the workmen.

The balance sheet of the company for the year ended Dec. 31, showed assets of $3,102,519, including $215,000 in cash; $94,000 in certificates of indebtedness; $10,000 notes receivable; $14,000 in trade acceptances; $245,000 in customers accounts, and $1,144,000 in merchandise inventory. The current liabilities included only $226,000 in accounts payable and $60,000 in mortgage bonds payable.

TO BUILD NEW BYARS TRACTOR

WICHITA, KAN., April 15—A new farm tractor designed by Edgar Byars, one of the original designers of American tractors, will be manufactured in this city by a company which will be organized by the designer. The Byars is an all-purpose tractor; the width of tread is adjustable from 46 in. minimum to 90 in. maximum. A new method of attaching lugs is provided; a simple gearing provides a positive square turn either right or left, and the speed on turn is the same as at straight going.

INDIANA S. A. E. MEETING SET

INDIANAPOLIS, April 15—The Indiana Section of the Society of Automotive Engineers has arranged to hold its next meeting April 29, at the Independent Athletic Club, this city. A six o'clock business mens' dinner will be served, after which the regular meeting of the Section will be held. The subject for discussion will be a paper on "Chassis Design." There will also be a four reel film on "The Making of Petroleum" gotten out by the Bureau of Mines

March Makes Record in California Sales

Southern Part of State Reports Exceptional Selling with Demand Increasing

LOS ANGELES, April 18—Indications are that the month of March established a new record for motor car and truck sales in Southern California. A recapitulation of car and truck registrations issued to-day shows 6259 cars and 747 trucks were registered during the month. This applies to new vehicles only and does not include motorcycles and tractors. There is no reason to doubt the authenticity of the report, and if it is correct it means that more new cars and trucks were sold last month than ever known before.

Ford deliveries came through with a bang during March, and of the totals 2820 cars and 407 trucks were of this one make. There are ten counties in Southern California and there was a liberal increase in sales, in all counties, with the biggest addition in Los Angeles city and county. From this city alone 4010 new cars were registered. The next big sensation of the registrations is the number of Studebakers sold. The figures credit Studebaker with 345 registrations, and this car led everything in its price class. Next to the Ford the Chevrolet was the biggest seller.

Truck registrations were particularly heavy. The registrations show that next to the Ford and Dodge came the Mack, which distanced all of the exclusively heavy-duty trucks. The sales of Macks show truck business outside of Los Angeles was exceptionally brisk, as 28 of a total of 41 were registered from elsewhere than this city.

Dealers assign the increasing number of motor vehicle sales to a return of confidence upon the part of the public, heavy advertising and consistently hard work. There has come an awakening to the fact that business has to be dug up and those who are driving the hardest are the ones who are getting results. To date this month indications are that April will prove even better than March.

MAXWELL PLANT ORDERED SOLD

DETROIT, April 18—A final court decree directs the sale at public auction of the Oakland Avenue plant of the Maxwell Motor Co., Inc., on May 12. The minimum bid acceptable is $10,925,000 under the court order. The sale will be a part of the reorganization plan under which the Maxwell company will be merged with Chalmers.

TO BUILD KENTUCKY REFINERY

LOUISVILLE, April 18—Construction of a new oil refinery, with a daily capacity of 1500 bbl., will be begun within the next thirty days by the Dixie Belle Refining Co. The new refinery will cost about $500,000 and will be built to convert crude petroleum into kerosene, gasoline and lubricating oil. The Dixie Belle Refining Co. does not itself own the wells from which this crude petroleum will be drawn, but will purchase it.

Construction of the refinery is expected to require five or six months for its completion. After the refining of oil has been begun the company will sell its products through the Kentucky Consumers Oil Co.

Premier Reorganization Brings New Confidence

INDIANAPOLIS, April 15—Work of reorganizing the old Premier company into the new Premier Motor Car Corp. is progressing rapidly, according to B. H. Miller of this city, who represents the creditors of the organization, among which is the Fletcher American National Bank. The company has been incorporated under Indiana laws, the corporation having taken over the Delaware corporation. By this method it is possible to add about $500,000 of new money. Under the new organization J. A. Price has been named president; I. F. Schaeffer, treasurer, and M. A. Whipple, secretary. Schaeffer is the only director remaining from the old organization.

Men back of the organization, including Miller, are more optimistic than they have been for some weeks past concerning the future of the corporation. Miller says it begins to look as though the company would pull itself together and get back on its feet in good shape. A. E. Doty, the new sales manager, has begun work and according to Miller, results already are being shown. Fifty cars have been sold during the past two weeks and to-day orders were received for twelve cars and thirteen were shipped from storage.

Studebaker Increases Light Six Production

SOUTH BEND, IND., April 18—Production jumped to 125 cars a day on the Studebaker light six this week. This brings the new plant within sight of its designed capacity of 150 cars a day which it is expected to reach in the near future. Vice President and General Sales Manager Biggs of the corporation said that it has been impossible to meet delivery requests for some time, and that production is steadily being built up to capacity. He believes that the present increase in sales is based upon a sound foundation and that there is every indication that it is permanent.

IOWA ENGINEERS MEET

WATERLOO, IOWA, April 16—A meeting was held here yesterday with the object of standardizing certain parts of stationary and portable gasoline engines, and similar manufactured products, as has been done in the case of automobiles, and other automotive products. R. S. Burnett, manager of the Standards Committee of the Society of Automotive Engineers of New York, represented the Society at the meeting.

Kansas City Trade Reacts Temporarily

Slowness of Farm Products to Move Delays Steady Business Progress

KANSAS CITY, April 18—Nearly every line of merchandise suffered a reaction the second week of April. Manufacturing, wholesaling and retailing were all on a lower level than the week previously, and much lower than the average for March.

Automobile sales showed a like reaction. The trade during April has been spotty. Sales rise for a day or so, and then fall—apparently all dealers having the same experience day by day. Wholesale trade continues extremely slow. Retail trade has on the whole been good, with movement close to normal, until the past few days. Declines in farm product prices constitute one factor.

Truck sales have declined more radically than passenger car sales. The farm demand has not yet arisen to constitute a balance for offsetting any temporary reaction in demand from city sources.

"Normal movement will come when surpluses are disposed of," said a Kansas City business man. The farmer must move his stocks on hand, and forget the prices he gets for them; merchants must move their surpluses—and the consumer must use up his surplus, and get normally into the market again, before trade can go ahead steadily.

It is reported that cheaper cars have a far greater demand than more expensive ones. A low-priced car dealer in Kansas City has been buying cars by wire from country dealers to meet his local demand for immediate deliveries.

COURT CONTINUES RECEIVER

INDIANAPOLIS, April 18—The petition to have a new receiver appointed in the place of William R. Hirst for the VanBriggle Motor Device Company, manufacturers of shock absorbers and trailers, was refused by Judge A. B. Anderson in adhering to his rule that a creditor who has accepted the appointment of a receiver for an insolvent in a State Court cannot come into the Federal court and have another appointed.

Bids have been received by Hirst on the company's plant which will not be made public until some time next week.

TO REVIVE ITALIAN RACE

NEW YORK, April 15—The famous Grand Prix of Italy will be revived during 1921 under the auspices of the Automobile Club d'Italia. Details are being arranged by the Automobile Club de Milan and the race will take place this summer on the same lines as the Grand Prix de France. In connection with this important event the light-car Grand Prix will take place at Brescia at the same time.

Alabama Business Rallies in Cities

Dealers Heavily Stocked, However, Due to Drop in Country District Demand

BIRMINGHAM, ALA., April 18—Motor car sales in this iron and steel center of the South, with a population of 178,000, are from 50 per cent to 60 per cent of normal in standard makes, and have shown a very great improvement in the last two months. With the exception of Fords and one or two other makes there is a 30-day supply of new cars in the territory and at least a 90-day supply of used cars.

One reason why new car sales are so good is that 75 per cent of the dealers are trading too heavily and making foolishly large allowances on trades. Some of them have had to do this because the banks are insisting that they move stocks and reduce loans. A bank calls on the dealer to pay a certain amount on a certain date, and to raise the necessary cash the dealer makes too large an allowance on new car sales. This is one of the reasons why the city is overstocked with used cars.

The market for used vehicles is not as strong as usual because the steel mills are not running at more than 50 per cent of capacity, and as a consequence many of the workers who might otherwise buy are out of the market. This condition prevails to a greater extent among the miners, because the mines are working at only 20 per cent of capacity. The Buick dealer reports that whereas he formerly sold 50 per cent of his cars to steel workers this business has ceased and sales are being made to salaried men and others not connected with steel.

Wholesale Trade at Standstill

Birmingham distributors generally have all of Alabama as their wholesale territory, and in most of this territory business is at a standstill. They have had no wholesale trade since September. Many of the territory dealers are liquidating their business as rapidly as they can and a considerable number already have closed up their affairs. Liquidation in many instances has been because of the fact that dealers were loaded too heavily with cars. They were financed by local bankers up to 80 per cent of the value of the cars, and these loans have been called because the same bankers financed the farmer for his 1920 crop.

The farmer has not sold his cotton, and for this reason has been unable to meet his loans. Most bankers are endeavoring to finance the farmer for his 1921 crop, and they must have cash. Many of the country dealers would gladly lose the 20 per cent they paid to the distributor for the cars, but the banks will not take over the automobiles and the dealer is forced to continue in business until he can dispose of them.

The cotton farmer will be out of the buying market for at least a year, and perhaps longer. There is little probability that he will be able to buy in September or October when the new crop comes in as he still has his 1920 crop on which the bank financed him, and if he disposes of it at the present price of 11 cents he will not be able to pay the bank which loaned as high as 14 cents a pound. In addition to his bank obligations, the cotton farmer has yet to pay for provisions, clothing and other supplies purchased from the town merchant. Many farmers already have made loans on the 1921 crop. The merchant is still giving credit on provisions and clothing. It is estimated that the cotton acreage this year will not exceed 50 per cent of last year.

Look for Fall Business

The conservative motor car dealer does not expect much business this fall in the rural sections and does not look for normal conditions before July or August, 1922. There are several counties in the State where the bankers are telling the farmers they will make loans on the 1921 crop provided motor cars are placed in warehouses. The only apparent reason is that the banker desires to force economy in every way.

Another unhappy phase of the situation for the motor car dealer is that banks are being compelled to take over cars on which farmers cannot complete their payments and turn them back to the dealers. This condition does not prevail to so great an extent in Birmingham, Montgomery and Mobile.

Some of the distributors have dismissed their wholesale organization and are centering their efforts on business in the cities and larger towns of the State. They have found that many of their salesmen are helpless now that an era of competition has returned and real salesmanship is necessary. Conditions in Birmingham probably are better than in any other city in the State notwithstanding the slump in the iron and coal industries.

Bank deposits in the cities have held up well but have fallen heavily in the country sections. There is a feeling that a great deal of money has been drawn from the country banks by farmers and hoarded as the banks have been unable to trace investment of these funds. Savings deposits in Birmingham banks have increased, and while bank clearances have fallen off 20 per cent, this is explained by the shrinkage in the value of commodities.

Cotton Sections Worst Hit

The southern section of Alabama is dependent largely on cotton and is in worse condition than other parts of the State where crops are more diversified. Mobile is surrounded by large vegetable areas from which shipments are made to northern cities during April, May and June. This should be a good time to exert sales efforts in this district.

Montgomery is a cotton center and business there is very slow.

Texas Finds Sales Improved on Farms

Dealers See Million Dollar Field When Normal Conditions Are Restored

DALLAS, TEX., April 16—The motor vehicle business in Texas was slightly improved this week, though dealers complained that the business was not up to the standard and said it probably would not be for several months. There was an increase in tractor sales and there was also an improvement in the automobile lines. Some dealers were reporting increased business in cream separators to farmers and small dairymen, and others found a good field for washing machines.

Financial conditions appeared to be improving and the dealers assert when these are back to normal the business would grow by leaps and bounds. The dealers declared the people are awake to the need and necessity of motor vehicles and motor implements, but are not buying them so readily because they can do without them for a time. Some of the dealers who are conducting intensified sales operations, coupled with considerable terms, are disposing of their goods about as easily as they did four years ago.

Not a dealer in Texas but realizes that people are alive to the advantages of motor vehicles, want them and are going to have them sooner or later. They are selling about what the people are able to assimilate under present conditions, and are awaiting the time when business will hum. As they put it, Texas is a virgin field for the business and one which will mean the spending of millions for motor vehicles and machinery in the next few years.

OHIO CODIFICATION DEFEATED

COLUMBUS, April 18—The bill introduced in the Ohio Legislature providing for a codification of all automobile laws of the state, has been killed by the house committee to which it was referred. This bill sought to codify all of the laws and to make radical changes and was opposed by the Ohio Automobile Association, an owners association. On the other hand the Ohio Automobile Trade Association favored the bill but the opposition was too strong.

REORGANIZE WRENCH COMPANY

WORCESTER, April 18—Reorganization of Walden-Worcester, Inc., manufacturer of wrenches here, is in progress, and in the meantime the business is being successfully operated by three receivers, William Woodward, Frank Kilmer, and Representative Edwin G. Norman. The new plant is being operated at normal capacity, running about 50 hours a week with a working force of more than 100. Under the proposed reorganization, it is expected there will be a number of changes among the officials.

Harding to Take Up Kansas City Policy

Credit Scrutiny to Be Lessened This Year—New Crops to Cost Less

(*Continued from page* 877)

The Governor, after first declaring that there never had been any singling out by the Federal Reserve Board, said that so far as he knew there was no reason why the automobile business should feel any special restrictions not equally applicable to other lines of industry.

The Governor was then asked if the Federal Reserve banks and in turn the member banks were calling upon borrowers for new credit statements. To which the Governor replied:

"We call for credit statements annually. I think this can be said safely now:

"CREDIT STATEMENTS ARE NOT GOING TO BE SUBJECTED TO THE SAME DEGREE OF SCRUTINY THAT THEY WERE A YEAR AGO."

Asked as to whether there would be a lowering of the discount rates, the Governor said:

"The average reserves in all the banks of the country is around 53.7 per cent. On April 16 the reserve in the Boston bank had been built up to 71.3 per cent. This is the ratio of total reserves to deposit and Federal Reserve note liabilities combined. Now the rate in the Boston district has been lowered. I leave it to your own judgment as to what will happen in the other districts when this ratio has been built up. It is largely mechanical and governed automatically."

In his conversation with Vane, Governor Harding said, among other things, concerning the general business situation:

Shortage Changed to Surplus

"This is no time to conduct a 'wake.'

"We thought a year ago that there was an actual shortage. The cry was 'Increase Production.' Consumption, however, has been reduced so that whatever over-production there is, is relative, rather than absolute. About a year ago it began to be noticed that the insistent demand for various commodities was falling off. From that position we advanced a step to a point where we found that there was no shortage as we thought, and then it developed that we had a surplus. While last year was one of physical plenty and the crops were bounteous the consumers' demand fell off. That is due primarily to the lack of a potential buying power in other countries."

"The reserve position of the Federal Reserve banks is now 53.7 per cent, against 42 per cent a year ago. This means a great deal."

"New crops ought to be produced at much less cost than crops of a year ago."

"People must make up their minds (in some sections) that they must get some capital loans—they may even have to mortgage property in order to tide the situation over."

"The agricultural sections are much interested in peace. We need an official peace and we need a cessation of hostilities and general pacification all over the world."

"Those people who have solved all their problems are in the cemeteries."

"Some of us fancied we had prosperity 18 months ago. Didn't we know conditions then were too good to last?"

"In nature we have the storm and the sunshine. There are some regions of perennial sunshine—Death Valley and the Sahara Desert."

"Now, so far as credit is concerned. Times like these are not the times when banks make new losses. In a period such as this banks must realize that they have a loss on transactions previously made, but it is a time also to be constructive. *It is safer to lend money now on present valuations than it was a year ago, and I think banks generally realize that what we want to do is to hold our domestic situation in hand, avoid drastic action of any kind, formulate constructive plans to live and let live and go the limit in extending renewals to those whose character and business ability show that they are entitled to accommodation.*"

The Governor's parting message to Vane was that:

"It is time to end the buyers' strike."

Boston Federal Reserve Reduces Discount Rate

WASHINGTON, April 18.—The Federal Reserve Bank of Boston has reduced its discount rates from 7 per cent to 6 per cent. This does not mean of necessity that changes will be made in the rates of other Federal Reserve banks, nor is it indicative of any contemplated changes, according to Governor Harding. Authorization of the reduction was granted because of the lessened demand for credit in the Boston district and because of the strength of the bank's reserves which have been as high as 70 per cent in the last six weeks. As credit conditions improve in other districts, it is not improbable that similar action will be taken.

SHERIDAN SEDAN COMPLETED

MUNCIE, IND., April 19—The first sedan from the production chain of the Sheridan Motor Car Co. has been wheeled out of the plant. A few minor changes in appointments will be made, it was said, but the general design and equipment will be unaffected. Production has not reached capacity, but shipments are taking all that present operations can turn out. Sales Manager Wilmoth expressed the fear that they would be oversold in a very short time. Frank Sealand, Cleveland distributor, was at the factory attempting to arrange for a large shipment.

Harvester Prices Cut to Steel Basis

Ten Per Cent Reduction Follows U. S. Steel Action—1920 Biggest Year

CHICAGO, April 18—The International Harvester Co. has announced a straight 10 per cent reduction, effective at once, on products in which steel is the principal raw material. This action is based on the reduction in steel prices announced by the U. S. Steel Corp.

"The reduction of steel comes after our year's production had been provided for and will have no bearing on the manufacturing cost of machines we sell this year," said an announcement by the company. "It does establish a lower replacement cost, and serves as the basis of a price to which our customers are entitled and which we are willing to accept."

The reduction applies chiefly to harvester machines. Reductions of from 10 to 15 per cent on machines made principally of wood and iron were announced on March 7.

The annual report of the Harvester company shows that notwithstanding domestic depression in the latter part of the year and difficulties in the way of foreign trade, its business for the year ended Dec. 31 was larger both in the home and foreign market than any previous year in its history. Sales amounted to $225,000,000, compared to $212,000,000 in 1919 and $204,000,000 in 1918. Foreign sales last year aggregated $60,000,000.

The report shows net profits, after all charges, of $16,555,353, equivalent after preferred dividends to 13.86 per cent on the $90,000,000 common stock outstanding at the end of the year, compared with $12,608,726, or 10.51 per cent on the $80,000,000 common stock outstanding in 1919. In the latter year, however, $7,403,033 was written off to complete a writing off of all war losses. The surplus for 1920, after deducting $10,000,000 transferred for stock dividends last September, was $68,350,741, compared with $71,645,388 in 1919.

The balance sheet shows cash amounting to $12,291,000, net receivables of $56,969,000 and inventories of $131,134,000. The liabilities include $33,153,000 in accounts payable and $11,785,000 in bills payable.

Deere Reduces Prices

MOLINE, ILL., April 18—Deere & Co. have announced a reduction of 10 per cent upon its general line of farm implements, effective immediately. The statement says: "The company's raw materials have been purchased at the higher prices and in its 1921 production receives no benefit of the recent steel reductions. The steel reduction, however, does furnish a new basis of replacement cost and the company is willing to take a loss to benefit dealer and farmer."

Sterling to Start Production at Once

Company Is Chartered with $1,000,000 Capital to Build High Priced Car

CLEVELAND, April 20—The Sterling Knight Motor Co. has been chartered with a capital stock of $1,000,000 preferred and 20,000 shares of no par value common stock to manufacture an automobile using the Knight sleeve valve engine. The car will rank in the high priced class. The vice-president and general manager of the company will be J. G. Sterling, for years engineer of the F. B. Stearns Co., which also manufactures a car using the Knight engine.

Associated with Sterling will be P. H. Withington of Toledo as president and treasurer, and Alonzo M. Snyder of Cleveland as secretary. In addition to the officers, the directors will be Alva Bradley, W. D. Gongwer, J. V. Thomas, C. O. Mininger, R. D. Jacobs and R. H. York, all of Cleveland.

It is understood that $250,000 of the preferred stock already has been subscribed and that payment on it will be handled through the Union Trust Co.

The new company will take over the work carried on during the past year by the Sterling-Knight Syndicate, an organization of Cleveland interests which financed the experimental work on the new automobile. Three cars of six cylinders have been built and tested and were exhibited at the automobile shows in Cleveland and Chicago. The new company intends to begin production immediately.

New Company Formed to Take Over Biddle

NEW YORK, April 20—The plant, equipment and assets of the Biddle Motor Car Co. have been purchased from the receiver by Ralph R. Owen, F. L. Crane of Cleveland, R. W. Stanley and associates, who will continue operations under the name of the Biddle-Crane Motor Car Co. Crane will be president of the company, Stanley, vice-president, and Owen general manager. Stanley was associated with the old company.

Operations will be continued with practically the same models as those previously built by the Biddle company and it is the purpose of the new owners to turn out a small, high class job which will sell at around $3,400. No attempt will be made to reach quantity production and if 200 cars are built this year the new owners will be well satisfied.

The Biddle car enjoyed an excellent reputation and the failure of the company was considered unfortunate. The inventory which was on hand at the time the receiver was appointed was adequate to complete a considerable number of cars except for two or three essential parts. These are now available.

NEWS BULLETINS

MEXICO CITY, April 20—(Special) Because of transportation difficulties, the automobile exposition, which was to have opened today in the National theater, has been postponed for ten days.

SHARON, PA., April 21—The Sharon Pressed Steel Co., with plants at Ellwood City and Wheatland, Pa., has been taken over for refinancing and reorganization by Harry W. Torney, of Torney & Co., Inc., New York; Albert W. Morris, formerly of the Harley Co., Springfield, Mass.; Arthur E. Swain, formerly of the Crucible Steel Co., Harrison, N. J., and their associates.

NEW YORK, April 21—Directors of the B. F. Goodrich Co. decided here yesterday to pass the dividend of $1.50 a share on the common stock. A. A. Tilney, of the Bankers Trust Co., and Harold Stanley, of the Guarantee Trust Co., were elected directors to succeed A. H. Marks and A. B. Jones, resigned.

NEW YORK, April 21—The directors of the General Motors Corp. were re-elected at the annual meeting of the stockholders yesterday.

At the organization meeting of the directors to-day all the old officers were re-elected. This list includes R. H. Collins as president of the Cadillac company.

NEW YORK, April 21—Creditors of the Bethlehem Motors Corp. probably will decide in the near future to wind up the affairs of the company, as proposals for a reorganization have met with little success. A meeting of creditors' committees is being held at Allentown to-day to consider the sale of certain assets, and the same subject will be taken up in Federal court at Philadelphia to-morrow.

Freight Reduction Asked on Trucks Shipped West

NEW YORK, April 18—A plea for revision of freight rates charged by Western railroads on motor trucks was made before the Consolidated Classification Committee here to-day by J. S. Marvin, general traffic manager of the National Automobile Chamber of Commerce. He urged that they be placed on a second-class basis subject to a minimum carload weight of 12,000 lb. This adjustment already has been granted by Eastern and Southern roads. The Western roads charge first class rates on both trucks and passenger cars.

Classification of several automobile and truck parts also was discussed at the hearing. The change in classification is of great importance to manufacturers because it would mean to them a difference of from $40 to $80 and more a carload on trucks shipped to points west of Chicago. The Consolidated Committee has entire control of freight classification under the reorganized system.

Control of Goodyear Passes to Syndicate

Bankers Will Direct Affairs of Company During Life of New Bonds

NEW YORK, April 21—Control of the Goodyear Tire & Rubber Co. has passed from F. A. Seiberling, now the president, to a syndicate headed by Dillon, Read & Co., New York bankers, which has underwritten $30,000,000 first mortgage 20 year 8 per cent sinking fund gold bonds due May 1, 1941.

During the life of the bonds the management of the company, with the right to elect a majority of the directors, will be vested in Clarence Dillon, John Sherwin, chairman of the board of directors of the Union Trust Co. of Cleveland, and Owen D. Young, vice president of the General Electric Co., or their successors, through management stock or a voting trust. Some changes in the present personnel are expected.

The syndicate which has underwritten the bonds, includes Goldman, Sachs & Co., which a few months ago made a temporary loan of $15,000,000; the National City Co., the Guaranty Co., Lee, Higginson & Co., the Chase Securities Co., and Blair & Co. The bonds are offered at 99, and the mortgage provides for the retirement of the entire issue at 120 and interest by drawing by lot $750,000 on each interest date beginning November 1, 1921.

The proceeds of the first mortgage bonds together with the proceeds of $27,500,000 10 year 8 per cent debentures, which will be offered to stockholders, will be used to pay the company's current obligations and to increase working capital. The mortgage provides that the company must maintain at all times net current assets equal to 125 per cent of the entire amount of bonds outstanding.

Approximately 70,000 stockholders and merchandise creditors assented to the plan for reorganization as presented by the bankers.

NEW YORK LICENSE BILL LOST

ALBANY, N. Y., April 19—The bill introduced by Senator Lusk, majority leader in the Senate, which would have increased the license fees for passenger automobiles and motor trucks, was lost in the shuffle in the closing hours of the legislature and did not pass.

The legislature adopted a resolution providing for a committee of senators and assemblymen to sit anywhere in the state and compel the attendance of witnesses preparatory to making a report at the next session recommending changes in the motor vehicle law and remedial legislation.

A bill also was passed transferring the automobile licensing bureau from the office of the secretary of State to the State tax department which will administer the motor vehicle law after July 1.

Willys and Chrysler Not at Odds

Working Together in Perfect Accord They Both Assert

Chrysler Has No Intention of Leaving—Companies Making Good Progress

NEW YORK, April 19—Walter P. Chrysler has not the most remote intention of severing his relations with John N. Willys. The executive vice-president of the great Willys enterprises has no differences with his chief and has had none. They are in thorough accord on all questions of policy. The main object in life for both of them is to bring the Willys-Overland Co. and the Willys Corp. back to their former impregnable positions, and in this endeavor they are making splendid progress.

Many unfounded, exaggerated and vicious reports regarding the relations of the two men and the two companies have been circulated for months, but each has deemed it wisest not to dignify them with denials. In the days when the Willys enterprises, like most of those in the automotive field, were at a standstill, they adopted as their own the old adage that "silence is golden."

Conditions now are rapidly changing. The industry has come to life and business is forging ahead. Willys-Overland is coming back and Willys is at the helm. He has taken the field for a long series of conferences with dealers, distributers and bankers, and the results have been amazing even to his own organization.

Willys has told his dealers the exact truth about the affairs of his company, and at last has come to the conclusion it is time to spike the insinuations that he had stepped into the background and that his relations with Chrysler have been strained to the breaking point.

Never Had Any Differences

His positive and emphatic statement that there never have been any differences between them was made in response to an inquiry from AUTOMOTIVE INDUSTRIES as to whether there was any truth in the report that Chrsyler soon was to join the General Motors Corp.

In this denial, Willys was joined with equal emphasis by Chrysler. They were together in the former's office when they declared without equivocation that there was no foundation whatever for reports of friction between them. Willys asserted there never had been any differences. They sometimes disagreed on questions of policy, Willys said, but he usually was convinced Chrysler was right, although the reverse frequently was true. He asserted he was thoroughly "sold" on Chrysler.

Chrysler declared he was "sold" on Willys and was proud to work for him. He told his chief he had no intention of going with General Motors.

"I know that," said Willys. "We have no secrets from each other."

Willys dismissed as unworthy of consideration the assertion that he had been criticized because he was paying so large a salary to Chrysler at a time when his companies are not in the best of financial position.

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White to Reduce Force Until Surplus Is Sold

CLEVELAND, April 18—It was learned here to-day that the White Motor Co., one of the largest truck manufacturing concerns in America will on May 1 reduce its working force from 5000 to 3000 employees. Orders are being received at the plant in excess of the production, but the curtailment in the working force is the result of the policy of the company in keeping up maximum production for months when other similar corporations were either closed or were operating on a greatly reduced schedule.

All last winter, the White company kept its full force of night and day workers going at maximum capacity. There was a slight reduction in hours worked each week after Jan. 1 and later the night staff was combined with the day. That was but a few weeks ago. As a result the company accumulated a large reserve stock of trucks. It is now drawing on these. Hence the curtailment in production.

MOTORCYCLE RATE ADVANCED

NEW YORK, April 16—The London Bureau of the Eastern Underwriter reports a radical revision of motorcycle insurance rates in Great Britain, after what one official calls "two years of appalling losses." The multiplying of accidents, the increased cost of repairs and the alarming number of thefts necessitate an entirely new scale of rates. In consideration of higher premiums, the insurance companies are assuming unlimited public liability risks.

P. O. EXTENDS TIRE SHIPMENTS

WASHINGTON, April 15—Under a new ruling of the Postal Department, automobile tires up to a weight limit of 35 lb. may be sent by parcel post to points in Mexico reached by the railroads from the United States. Tires, likewise, may be sent under the same conditions from Mexico to this country.

Mott Heads Staff to Advise G. M. C.

Will Take Over Work Formerly Devolving Upon A. P. Sloan —New Members Named

NEW YORK, April 18—The following statement was authorized to-day by the General Motors Corporation:

"C. S. Mott, who has been a vice-president and director of General Motors Corp. for some years, has been made chief of the advisory staff with headquarters in the General Motors Building, Detroit. Mott will take over all duties which heretofore devolved upon Alfred P. Sloan, Jr., New York, who found it impossible to devote the time necessary to the corporation's affairs in Detroit. The advisory staff being located in Detroit, it was necessary for the vice-president in charge of that staff to be similarly located in Detroit.

"The advisory staff consists of a board of experts in the various sections of the corporation's activities who can be called upon when desired by the various operating divisions for consultation and advice upon broad and fundamental matters which each division could not attempt to develop for itself. Mott will be responsible for this organization.

"The appointments on the advisory staff made up to this time consist of: A. B. C. Hardy, director purchasing section; H. L. Barton, director of manufacturing; Eric L. Bergland, director of power house and building construction and design; Norval A. Hawkins, as already announced, recently joined the advisory staff as director of advertising, sales and service; C. F. Kittering, who is also a vice-president of the corporation, is a member of the advisory staff in charge of the research engineering and design section, with headquarters at Dayton, Ohio."

MULLINS TO MOVE BODY PLANT

NEW YORK, April 19—Because of labor trouble in its plant in Salem, Ohio, the Mullins Body Corp. announces that it has taken an option on a fully equipped plant at Detroit and will be in a position to start operations there on a large scale in a short time. The labor difficulties developed at Salem a month ago after the corporation announced a nine hour day to which the men objected and were locked out. Subsequently every large plant in Salem adopted the same policy, and as a consequence the five largest factories of the town are closed. The Mullins corporation has a large number of orders on hand.

Industry to Oppose Road Tax Bill

Fears Perpetuation of Excise Burden

Struggle Expected Because of Senate Backing—Work on Tariff Measures

WASHINGTON, April 19—Introduction of the Stanfield bill providing for a Federal highway fund through the segregation of revenues derived from automobile taxes has brought new complications for the industry. It is understood that the National Automobile Chamber of Commerce is opposed to the principles contained in the Stanfield amendment because it believes it would practically perpetuate the war-time taxations which have of late proved extremely burdensome.

Indications are that the industry will have a fight on its hands in opposing this proposed fiscal legislation because it has the indorsement of leaders in the Senate Finance Committee.

This amendment transcends in importance other tax proposals, principally because it may eventually block efforts of the organized industry to have the excise tax repealed. It is stated that the taxation committee of the N. A. C. C. will adopt a practical program opposing this plan. It is evident, however, that it must proceed with caution if it is to adhere to the plan for a national highway system.

The Stanfield amendment reads as follows:

Stanfield Bill Feature

"That on and after July 1, 1921, the receipts from the taxes imposed by subdivisions (1), (2), and (3) of section 900 and subdivision (11) of section 1001 of the Revenue Act of 1918 shall constitute a separate fund in the Treasury, to be known as the "Federal Highway Fund," to be used only for the expenditures authorized by law incurred in building or aiding the several States and territories in building public highways. The Secretary of the Treasury may use such fund for other purposes, but such fund shall be reimbursed for any portion thereof so used.

"Section 2: That when used in this Act, the term 'building' includes the selection, designation, location, survey, planning, improvement, maintenance, and all other necessary expense incident thereto, as well as the construction of such roads, trails, or highways."

Senator Stanfield, in a statement to AUTOMOTIVE INDUSTRIES said:

"If this becomes a law it will provide a continuing fund limited only by the amount of revenue this source will produce annually. A tax of three per cent is now imposed upon motor trucks and five per cent on automobiles, motorcycles and tires. For the year ending June 30, 1920, the revenue collected from this source amounted to $145,963,039.62. It is stated there are 2,500,000 miles of public roads in the United States of which about two per cent are of national or interstate importance, ten per cent State and eighty-eight per cent county and district roads."

Would Segregate Taxes

In segregating this fund, it is intended to provide any additional amounts in provisos, if necessary, that the war tax is not to be included in the price bill. In other words, it is the intention of the Oregon Senator to make the manufacturer pay the excise tax directly and not pass it on to the owner. It is said that he has a measure pending in the drafting committee which would require the manufacturer to make tax returns separately and not include other Federal taxes. By this provision it is expected that simplification would result in accounting for the amounts due the Federal highway fund which would be created under the bill. The tax on company earnings, etc., would continue to be used in the general tax fund.

Senator Penrose announced to-day that tax hearings before the Senate Committee on Finance would start after the Senate had disposed of the emergency tariff and its companion measure, the anti-dumping bill. Hearings have been held here this week on the affiliated measures and a bitter fight is anticipated when the bill is reported out of the Finance Committee. Senator Penrose has announced that he will personally direct the campaign on the Senate floor. Hence, it will not be possible to hold hearings on Internal Revenue revision for several days.

Discussions to Open in May

If the well laid plans of Senate leaders are fulfilled, the tax discussion before the committee will begin about the first week in May. Senator Penrose, however, does not expect to have the tax measure written into the statute before September. Therefore, whatever measures are finally adopted by Congress must of necessity be largely retroactive, as the fiscal year will be well under way when the revenue bill is enacted.

The anti-dumping bill, which passed the House as part of the emergency tariff, has met considerable opposition in the Senate, particularly as to the exchange items. George Davis, chief special agent of the United States Customs Service, has suggested that the duty should be based on prices paid by American importers abroad, and the amount thus determined could be converted at current

(*Continued on next page*)

Buick Discontinues St. Louis Operations

All Machinery and Equipment Moved to Flint—G. M. C. to Retain Plant

ST. LOUIS, April 19—It was learned to-day that the Buick plant of the General Motors Corp. in this city is being moved to Flint, the home of the Buick company. The transfer of the equipment and much of the machinery has been going on for several days. All except office equipment has been moved, it was said at the plant to-day. The purpose of the move could not be learned from L. E. Kurtz, general manager. "We are not yet ready to make any announcements," he said.

J. S. Hunt, manager of the Chevrolet plant which occupies half of the $4,138,000 structure, said Buick cars will hereafter be manufactured exclusively in Flint, where General Motors already has its largest Buick plant. He was unable to say at this time what use will be made of the St. Louis plant. He denied that the building would be used by any other than the General Motors Corp.

Construction of the General Motors plant on Natural Bridge Road started in April, 1919, on 40 acres of a 105-acre tract. The plant had a large assembly capacity and employed 1200 men when running full force.

G. M. C. Confirms Discontinuance

NEW YORK, April 20—Confirming the discontinuance of operations at the Buick St. Louis branch, General Motors Corp. to-day issued the following statement:

"The Buick Motor Co. has removed all machinery and equipment from St. Louis and will for the present concentrate all manufacturing operations at Flint. Plans for the future utilization by General Motors Corp. of the plant at St. Louis have not been formulated."

Indianapolis-Chicago Air Service to Start

INDIANAPOLIS, April 15—Aerial transportation service between Indianapolis and Chicago starts April 15, according to announcements by Dr. John K. Kingsbury of the Indianapolis Aero Association, for which a charter was filed in the office of secretary of state yesterday. The company is capitalized at $100,000. John P. Koehler and Leslie Sanders are associated with Dr. Kingsbury. C. S. Crawford, formerly with Premier, has been elected a director.

Industry to Oppose Road Taxation Plan

Retroactive Features of Proposed Anti-Dumping Measures Not Favored by Officials

(*Continued from preceding page*)

exchange rates at the time of importation.

J. D. Nevins of the same Federal organization has asked that the equalization of exchange clause contained in the emergency anti-dumping bill should apply only to shipments after the passing of the emergency act, and not to be retroactive as proposed.

It is anticipated that the exchange provisions of the anti-dumping bill will do much to check the influx of surplus war materials, including motor trucks which have been sold in large quantities by foreigners at prices far below American production costs. It is believed that in making the exchange provisions retroactive the large profits derived from the sales of surplus trucks on American markets would, to a large extent, be wiped out.

Senator Smoot of Utah has declared that he will oppose a permanent anti-dumping measure which does not contain provisions applicable to reimportation of trucks. Automobile dealers of the West and Middle West have appealed to the Utah Senator to protect them against unfair foreign competition. They claim that the sales of American made trucks originally sold to the Army, and then resold as surplus to foreigners, are being offered on domestic markets here at prices which they cannot meet.

Coast Highway Bill Offered

WASHINGTON, April 19—Congressman Baker of California to-day introduced a bill in the House which would authorize the examination, survey and report by the War Department as a preliminary to the improvement, construction and maintenance of a system of motor truck highways to make the transport requirements of heavy commerce in time of peace and of heavy ordnance in time of war and to serve as post roads with proper and sufficient laterals, in the States of California, Oregon and Washington.

Propose Highway Department

WASHINGTON, April 18—Congressman Osborne of California has introduced a bill to create a Department of Federal Highways, to establish a national highway system, to promote efficient and economical highway transportation, and to amend an Act to provide that the United States shall aid the State in the construction of rural post roads.

The bill is similar to that printed at the last Congress and discussed before the Senate and House Committees on Post Office and Post Roads. The principles enunciated in this measure have been indorsed by the National Automobile Chamber of Commerce, the American Automobile Association and other leading organizations who have advocated a system of interstate roads.

It is provided that bonds shall be issued on and after July 1, 1921, up to and cluding July, 1926, to be named as United States National Highway bonds, to an amount not exceeding in any fiscal year the amount of the appropriation in this act provided for the current fiscal year during which bonds may be issued.

President Gives Assent to Aviation Program

WASHINGTON, April 19—President Harding submitted to Congress to-day a special report of the National Advisory Committee for Aeronautics which made numerous suggestions for the development of air navigation. The President stated that the program of the committee met with his approval. From the viewpoint of commercial aviation, the most important suggestions are:

Establishment of a bureau of aeronautics at a cost of $200,000 a year under the Secretary of Commerce for the regulation of air navigation and the encouragement of civilian and commercial aviation.

Development of a system of national continental air routes to cover the United States and include a meteorological service.

Extension of the air mail service.

To enable the army to go forward with its air routes to cover the country an appropriation of $2,000,000 is recommended. Legislation also is requested definitely authorizing the Post Office Department to establish air mail routes between Chicago, Minneapolis and St. Paul, between Chicago and St. Louis and other routes advocated by the Postmaster General.

APEX MOTORS REORGANIZED

DETROIT, April 19—Apex Motor Corp. of Ypsilanti, manufacturer of the Ace car, has undergone a reorganization and H. T. Hanover is president and general manager, succeeding O. W. Heinz. The creditors' committee with representatives of the finance companies who are back of the Apex has agreed to a year's extension on outstanding accounts. This covers about 97 per cent of the creditors and puts the company in good condition.

ALL-AMERICAN MAKES PROGRESS

CHICAGO, April 20—The creditors' committee which has been conducting the affairs of the All-American Truck Co. since last November has sent a letter to holders of the serial notes of the corporation informing them that from the standpoint of creditors, conditions are as satisfactory as they could be under the circumstances and continuation of the business under the present plan will yield the greatest profits.

Willys and Chrysler Working in Harmony

Activity of President Among Dealers Restores Confidence—Reticent on Financial Plans

(*Continued from page* 885)

"He's the cheapest man on the pay roll," he declared, "and worth every cent he gets. When you have a $115,000,000 business you need men with brains, and Chrysler has them. That's what we're paying him for."

Willys returned late yesterday from a long series of conferences with Willys-Overland dealers and distributers, in which he filled them with enthusiasm over the future. He will start out again to-morrow, and the hours in between had been filled with conferences, but he was full of fight, aggressiveness and confidence.

"This trip of Mr. Willys' out among the dealers has been wonderful," said Chrysler. "The whole situation has been turned directly about. The dealers are full of confidence and enthusiasm. We're selling cars and we're building them, but we're not making any more than we're selling, and we're not going to. I made that statement months ago and it stands. It wouldn't be good business. But we're working 6000 men at Toledo and with Charles B. Wilson at the head there and the present fine organization, we're going to fill orders as fast as we get them."

Willys spoke delightedly of his conferences with dealers and distributers in Chicago, Omaha, Kansas City, Oklahoma City, Dallas, St. Louis, Minneapolis, Charlotte, N. C., and Atlanta. He starts out again to-morrow for similar conferences at Indianapolis and Toledo.

"I've shown the boys," Willys said, "that I'm not dead and that the company is not going broke. I've nailed a lot of misstatements that have been going around and have tried to clarify the situation. I've just given them facts and the response has been wonderful. After each of these conferences the distributers have been busy booking orders, although we didn't ask for any business. I've invited bankers to come to these meetings, and I feel certain they understand a lot of things that they didn't before."

Delay Opening New Plant

On the subject of the refinancing program for Willys-Overland and the Willys Corporation, the "chief" was somewhat reticent.

"If I talked about it," he said, "a wrong impression might get out. Everything is running along smoothly."

Chrysler was asked about the opening of the great new plant at Elizabeth.

"Mr. Willys can answer that better than I can," was his reply.

"That's in the future," remarked Willys, "and let the future take care of itself."

Cleveland Section Hears L. H. Pomeroy

Possibilities of Higher Efficiency by Increasing Compression Ratio Are Shown

CLEVELAND, April 16—At the meeting of the Cleveland section of the Society of Automotive Engineers held here last night, Lawrence H. Pomeroy delivered a talk on the fundamentals of engine design. Pomeroy emphasized the importance of lightweight construction in order to realize the greatest possible efficiency in engine design. He pointed out the possibilities of obtaining higher efficiency by increasing the compression ratio. He stated that compression ratios of 4½ to 1, which is about as high as it is well to go in the overhead type of engine, are suitable for obtaining good performance results.

The speaker, who has on previous occasions pointed out the advantages of lightweight pistons, connecting rods and other reciprocating units, also emphasized these points in his talk on engine design. The lecture and the discussion which followed brought out the fact that many engineers are committed to the school of design, which favors the lightest weight construction, not only in the reciprocating parts, but in the revolving engine parts such as the crankshaft and camshaft. The use of the drilled camshaft and crankshaft has resulted in a material reduction of weight in these parts without sacrificing rigidity.

Regarding the oiling systems, Pomeroy stated that normal oil pressure should range from 20 to 30 lb. per sq. in. The oil should be supplied not only at this high pressure, but in sufficient volume to permit the oil to act as a cooling medium as well as a lubricant. The use of high pressure oil, fed in large volume, fits in well with the hollow crankshaft and camshaft construction, permitting of leads through the center of these shafts, thus not only providing the natural lead for the oil, but also taking advantage of centrifugal force in the oil feed.

Dr. Pomeroy confined his talk to engine design and did not take up the question of fuel which he regards as an entirely separate problem. His stand for a 4½ to 1 compression ratio, however, indicates that with this type of engine design, the use of some means to prevent detonation would be necessary.

In addition to the talk by Pomeroy, some interesting entertainment features were included on the program and an informal banquet was held just before the meeting. The annual election of officers also took place.

SUBMIT HEADLIGHT PROPOSALS

NEW YORK, April 18—The Illuminating Engineering Society has submitted its "Automobile Headlighting Specifications" to the American Engineering Standards Committee for approval. The specifications are submitted in accordance with the special provision in the procedure of the committee, under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The specifications have been adopted in their essential details by the states of Wisconsin, Connecticut and Maryland, and by the Province of Ontario, and have been endorsed by the Standards Committee of the Society of Automotive Engineers; by the International Traffic Officers' Association, and by the conference committee on Uniform Vehicle Laws, representing some 30 different organizations, under the auspices of the National Safety Council.

Restrict Patent Rights in Advance-Rumely Suit

MILWAUKEE, April 18—The Court of Appeals for the Seventh Circuit has sustained the findings of Judge Ferdinand A. Geiger of the United States District denying the claim of the Advance-Rumely Co. of Illinois, against the John Lauson Mfg. Co., New Holstein, Wis., alleging infringement of patents purporting to cover broadly the practical use of kerosene as a fuel for internal combustion engines. The case has been in the Federal courts for five years.

Judge Geiger of Milwaukee held that in view of prior usage and expired patents the patents of the Advance-Rumely Co. must be restricted to minor details of construction, and that these patents involved no broad novelty in the use of kerosene as a fuel and were not infringed.

The suit was of vital importance to engine builders using kerosene as a fuel, due to the fact that if the courts had placed an interpretation upon the Advance-Rumely patents, as put upon them by its attorneys, all manufacturers of engines using kerosene as fuel in the United States would have been compelled to pay tribute to the Advance-Rumely Co. The alleged invention was specifically directed to the well-known principle of hydrating kerosene to prevent pre-ignition.

BATTERY RECEIVER PETITIONED

BLOOMINGTON, ILL., April 18—Four creditors of the Illinois Storage Battery Mfg. Co., Hoopeston, Ill., filed a petition in involuntary bankruptcy in the United States District Court, asking that the concern be declared bankrupt and asserting that it is insolvent. An investigation is sought by the referee in bankruptcy. The battery company was organized nearly two years ago by Ray Murray. It was capitalized at $25,000, most of the stock being held by residents of Hoopeston. Following the organization the company appeared to flourish. Later disagreements arose in the ranks of the stockholders resulting in the departure of Murray, who sold out his stock. During the past few months business has slumped and the plant has been inactive. It is probable that a receiver will be appointed.

METAL MARKETS

MUCH mischief has been done by the exaggerated headlines under which the news of the recent change in the U. S. Steel Corporation's prices was published in many of the daily newspapers. An utterly false impression has gone forth that as the result of this price revision by the leading interest the steel market rules considerably lower than it did before this announcement was made. The fact is that, excepting in a few specialties, bargain offerings, which were plentiful a few weeks ago, have largely disappeared and the views of independent producers, as to prices for the time being at least, have become firmer. The Corporation, to all intents and purposes, had been "out of the market" when it revised its prices downward and the independents had what market there was to themselves. The quotations of the latter to-day are, barring a few exceptions such as steel pipe, at least as high and in some instances higher than before the Corporation's change in prices. Utterly absurd are statements like the following telegraphed to one of the New York dailies by its Pittsburgh correspondent: "With a stabilized steel market, builders and manufacturers are expected to go ahead with the knowledge that steel prices are virtually fixed for the next year or two." No one in the steel industry, either within or without the Corporation's breastworks, whose opinion is at all worth while, deludes himself into the belief that steel prices "have now been virtually fixed for the next year or two." Those with whom the wish for stability is father to the thought will go only so far as to say that from now on further cuts in prices must wait upon corresponding cuts in wages and freight rates. Inasmuch as the best economic thought is unanimous in the opinion that if general economic disaster is to be averted, both wages and freight rates must be brought down to saner levels without delay, the more conservative element in the steel industry is of the opinion that the prevailing quotations will continue as at least nominal prices until the advent of lower wages and freight rates. There are those, however, who fear that failure of present prices to bring out a sufficient quota of orders will lead to renewed price cutting in the near future. This element is of the opinion that the tonnages which the Corporation's price revision will add to its unfilled orders will be relatively light, and that before very long the independents will be setting the pace once more by cutting under the Corporation's new prices.

Pig Iron—Automotive foundries in Michigan and Ohio are releasing additional tonnages of foundry and malleable. The market is flat, with $25, Valley, for malleable and foundry No. 2 the maximum quotation.

Steel—Some independent producers appear willing to accept fresh orders for cold-rolled strip at around 5.75c., base, Pittsburgh, while others quote 6c. Automotive consumers have about finished quotas due them on old contracts, but are not placing fresh contracts. Hot-rolled has been reduced by a leading independent to 2.85c. Automotive spring steel is in better demand. The sheet market is a shade firmer, but this may be only the temporary result of advances by some of the independents in response to the Corporation's price changes. Youngstown district mills have booked some light business for full finished sheets at 5c.

Aluminum—Quiet with light routine demand from the automotive industry.

FINANCIAL NOTES

Marathon Rubber Products Co. of Wausau, Wis., has been incorporated with a capital stock of $300,000. The company will take over the plant and equipment of the defunct Burlock Rubber Clothing Co. of Wausau. The property was bid in at receiver's sale by J. H. Hieb of Merrill, Wis., for $61,000.

Stephenson Motor Truck Co., Milwaukee, which failed about nine years ago, has been brought into court for final adjudication by the adoption of the final report of the trustee and the declaration of a final dividend of 2 per cent, making a total distribution of 35 per cent of claims.

Doss Rubber & Tube Co., Atlanta, has been granted license to sell $100,000 of preferred stock, paying 8 per cent, by the Georgia Securities Commission. The Doss company manufactures tires and tubes, having a factory in Atlanta that has been in operation some years.

Brown Mfg. Co. has been organized at Brunswick, Ga., with a capital stock of $100,000, by Samuel E. Brown and others, for the manufacture of a quick change rim for automobile tires invented by Brown.

Templar Motors Co. has formed a subsidiary to be known as the Templar Motor Co. of New York, which will have an authorized capitalization of $1,500,000.

Fisher Body Corp. will pay a dividend of 1¾ per cent on May 2 to preferred stockholders, and a dividend of $2.50 a share on the no par value common stock.

Rolls-Royce of America, Inc., has placed, privately, $2,000,000 in 8 per cent notes due March 1, 1931, and there will be no public offering.

O. K. Giant Battery Corp. has been organized in Atlanta with a capital stock of $75,000, by F. K. Adams, F. L. Cook and J. C. Rucker.

INDUSTRIAL NOTES

Diamond-Holfast Rubber Co., Atlanta, manufacturers of automobile tire patches and other patented rubber products, has purchased an eleven acre site in suburban Atlanta for $20,000, and will build a modern factory, to include salesrooms and general offices.

Air Reduction Sales Co. has secured control of the National Carbide Corp. of Virginia, with a new plant at Ivanhoe, Va., and beginning May 1 will direct the policy and control the operation and sales of the Carbide corporation.

E & W Co., Milwaukee, manufacturer of commercial car attachments for passenger car chassis, trailers, trailer-trucks, etc., has accepted the proposition of business men of Cedarburg, Wis., to transfer the operation to that city.

General Device Corp., New Lisbon, Wis., will start work at once on the erection of a factory, 75 x 150 ft., one story, equipped with new machinery and tools for manufacturing a line of patented devices and appliances.

G. Elias & Bro., Inc., Buffalo, has acquired membership in the Manufacturers Aircraft Association, New York. This is the twenty-first airplane company to join the organization, sixteen of which are active still.

Allan-Diffenbaugh Wrench & Tool Co., Baraboo, Wis., has filled original orders calling for 80,000 wrenches, and is receiving forgings and other materials for a second complement of the same size.

Flood Tractor Co., Spokane, is to change its name after May 1 to the International Automotive Corp., and will be reorganized with increased capital to manufacture a new standard tractor.

Kelsey Wheel Co., Memphis, Tenn., is nearing completion of its new body plant, which is expected to have a production capacity of 500 bodies a day.

Badger Brass Co., Milwaukee, is contemplating the erection of an entirely new and much larger foundry and machine shop during the summer and fall.

Tubular Steel Automobile Wheel Mfg. Co., Spokane, has started the manufacture of patented wheels made of tubular steel with galvanized iron spokes.

Modern Tool Co. announces arrangements whereby the E. L. Essley Machinery Co., Chicago, becomes exclusive selling agents in Chicago territory.

Kenison Mfg. Co., Solomon, Kan., has adopted the Climax Model KU, 5 x 6½ kerosene engine, as regular power equipment for its 15-30 tractor.

Victor Tool Co. has opened a New York office at 131 West Thirty-ninth Street, with F. W. Curtis as manager and Warren J. Boe sales engineer.

Laminated Shim Co., manufacturers of laminum for shims, will remove on May 1 to a new plant and offices in Long Island City, N. Y.

Motor Wheel Corp., Lansing, has opened a New York office, which will be under the management of Thomas J. Wetzel.

Armstrong Rubber Co., Garfield, N. J., reports operating 24 hours daily and production of 100 per cent of capacity.

Antigo Tractor Corp., Antigo, Wis., has five machines in process and will place them in the hands of users by June 1.

Emerson-Brantingham Implement Co., Inc., will locate its New York export office at 50 Church Street after May 1.

Paragon Motor Car Co. will remove its plant and general offices from Connellsville, Pa., to Cumberland, Md.

Republic Rubber Corp. has adjourned its annual meeting, scheduled for April 14, for another thirty days.

Petroleum Motors Buys Rockford Factory Site

ROCKFORD, ILL., April 15—Petroleum Motors Corp., organized to manufacture a low grade fuel burning engine, has acquired a tract of ten acres in this city on the Chicago, Milwaukee & Gary railroad, a belt line put in by the city of Rockford for the benefit of its manufacturing interests, on which to erect its factory.

The product, designed for truck use, is a four-cylinder, four-cycle, opposed piston engine with cylinders cast in pairs and has been under experimental observation for two years. The company is incorporated under the laws of Delaware for $1,250,000 with Chester A. Harris, president; T. G. Jackson, vice-president, and Charles C. Grassell, secretary-treasurer. They with L. A. Peil and B. J. Knight constitute the board of directors. R. C. Dale is manager.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, April 21—The most noteworthy feature in the money markets last week was the announcement by the Boston Federal Reserve Bank that its discount rate on commercial, industrial and other unsecured paper had been reduced from 7 per cent to 6 per cent. At the same time the discount rate on notes secured by certificates of indebtedness was raised from 5½ per cent to 6 per cent, making all the published discount rates of the Bank uniform.

The New York call money market last week was much firmer than a week ago, with rates at 6 per cent to 7 per cent, as against 5 per cent to 7 per cent the previous week. Renewals were consistently at 7 per cent. Time money was also a trifle firmer, with 6½ per cent quoted for all maturities from sixty days to six months, as against 6¼ per cent to 6½ per cent the week before.

The total foreign trade for March showed a decline of more than $700,000,000 from the figures for March, 1920. Exports for the month totaled only $384,000,000, as compared with $489,000,000 in February and $820,000,000 in the corresponding month a year ago. Imports at $252,000,000 were larger by $37,000,000 than the total for February, and compared with $524,000,000 in March, 1920. For the nine months ended March, 1921, exports totaled $5,509,000,000, as against $6,050,000,000 for the same period a year ago.

Imports for the nine months' period totaled $3,009,000,000, as against $3,759,000,000 for the nine months ended March, 1920. March exports were the smallest for any month since the beginning of the World War, while imports made the largest monthly total for any month in 1921. The excess of exports for March at $132,000,000 was the smallest since last August.

U. S. SURPLUS $10,000,000

NEW YORK, April 20—Stockholders of the United States Rubber Co. were informed by Samuel P. Colt, chairman of the board of directors, at their annual meeting yesterday that earnings for the year 1920 were about $10,000,000 over and above dividend requirements and that regular dividends at 8 per cent have been paid on both preferred and common stock.

All the directors of the company were re-elected and John W. Davis, former ambassador to Great Britain, was added to the board.

ADVANCE-RUMELY CUTS PRICE

LAPORTE, IND., April 20—The Advance-Rumely Co. announces a 10 per cent reduction in price on all its farm machinery in which steel is the chief raw material used. This follows the price reduction recently made by the United States Steel Corp.

MEN OF THE INDUSTRY

H. M. Salisbury has been appointed export manager of Maxwell-Chalmers. Salisbury is a veteran of the industry, having been connected with General Motors Export Corp.; F. B. Stearns Co., New York, and John N. Willys Export Corp. In joining Maxwell-Chalmers he succeeds H. W. J. Russell, who resigned because of ill health.

Charles S. Crawford, former chief engineer of Premier, has been elected a director and consulting engineer for the Kant Kut Ignition Tube Co., Indianapolis. He has also been elected a director of the Indianapolis Aerial Association, which will operate a passenger air service between Indianapolis and Chicago.

Henry G. McComb, who for several months past has been doing sales engineering survey work for the American-La France Fire Engine Co., Inc., Elmira, has definitely joined the forces of that concern in connection with its new motor truck development. McComb will be stationed at the sales office, New York.

P. A. Tanner, who for the past five years has been connected with the Splitdorf Electrical Co. of Newark, N. J., and its subsidiaries in various capacities, has resigned as advertising and service manager and will spend the summer touring and looking after personal interests in Iowa and Missouri.

E. S. Crocker, who used to serve in an engineering capacity at the Chalmers Motors Co. and who during the war was connected in the development of the four-wheel-drive artillery tractor, has become chief engineer for the Rainier Truck Corp. at Flushing, L. I.

Victor T. Goggin, late New England sales manager of Fred T. Ley & Co., Inc., of Springfield, Boston and New York, has severed his connection with that concern to associate himself as contracting engineer with Dwight P. Robinson & Co., Inc.

W. G. Clay has been appointed assistant sales manager of the truck and tractor division of the Traylor Engineering & Mfg. Co., Cornwells, Pa. C. H. Patten and J. L. Fulton were appointed chief engineer and production engineer, respectively.

H. G. Egbert, treasurer of the Master Tire & Rubber Co., Dayton, and H. J. Alperin, owner of a chain of tire stores in Cleveland, Chicago and New York, have become connected in executive capacities with the Chillicothe Tire & Rubber Co.

J. E. Tracy, for the past four years general sales manager of the Sterling Motor Truck Co., Milwaukee, has become actively connected with the Hicks-Parrett Tractor Co., of Chicago Heights, as vice-president and director of sales.

George Pearson, Jr., former district supervisor for Maxwell-Chalmers in San Francisco, has resigned to become sales manager of the Union Motors, Inc., a new Los Angeles concern handling Maxwell-Chalmers products.

Henry H. Knapp, formerly treasurer of U. S. Light & Heat Corp., Niagara Falls, N. Y., has been elected treasurer of the H. B. Shontz Co., New York distributors of USL batteries and also distributors of equipment.

S. N. Clemons, for the past seven years assistant purchasing agent for the Northway Motor & Mfg. Co., recently resigned to become identified with the Mid-Western Sales Corp., Detroit, as general sales manager.

E. F. Jones, who recently resigned as president of the Republic Rubber Co., has been appointed assistant to Jerome R. George, vice-president of the Morgan Construction Co., Worcester, Mass.

E. E. Eby has joined the Remy Electric Co. in the capacity of purchasing agent. Eby was formerly American director of Delco-Remy, Ltd., and Hyatt, Ltd., with offices in New York.

N. C. Beerend has been named sales and advertising manager for the Jorgensen Mfg. Co., Waupaca, Wis. Beerend was formerly connected with Walters, Gemco and Badger, all of Milwaukee.

Robert R. Keith, formerly of the Moline Plow Co. in charge of the Universal Tractor Works, has been made superintendent of tractor works of the International Harvester Co. at Chicago.

Russell B. Reid, for several years past with Edward R. Ladew Co. as assistant sales manager, has been made manager of sales for the Sharon Pressed Steel Co., of Sharon, Pa.

Harry Schleininger, for nine years general sales manager of the Motor Car Equipment Co., New York, has been appointed sales manager of the Kellogg Mfg. Co., Rochester, N. Y.

James A. Patten has been elected to the board of directors of the Advance-Rumely Co., to succeed F. N. B. Close, of New York, who resigned to take up business in France.

J. Emerson, who was the purchasing agent of the King Motor Car Co. before it went under new ownership, again is connected with the company in the same capacity.

H. A. Winterknight, Jr., sales manager of the Manley Mfg. Co., of York, Pa., has resigned and is now associated with the Finchbaugh Machine Co. of that city.

A. H. P. Leuf has succeeded Robert I. Erlichman as president of the General Utility Co., makers of automotive necessities, Philadelphia.

Ward H. Marsh has been appointed assistant sales and advertising manager of the Lincoln Motor Car Co.

F. H. Shaw has been elected a director of the Elgin Motor Car Co., succeeding J. M. Snitzler.

Edwin S. Beggs has been appointed sales manager of the Planet Mfg. Corp., Detroit.

Class Journal Editors Visit Standards Bureau

WASHINGTON, April 19—Direct personal contact between representatives of technical journals and of the Bureau of Standards made during visits to the bureau are of the greatest possible value, according to a statement issued by the bureau relating to a trip made by a number of business paper representatives. During recent years, the bureau announcement says, the co-operation between the bureau and the industries has been particularly close and this work has been greatly aided by the valuable publicity given the bureau's researches by the technical journals.

Those making the visit on the date named were from leading journals in the automotive field, the statement says, who made a general inspection of the bureau's laboratories and equipment. They were: Erik Oberg, editor of *Machinery;* David Beecroft, Ray W. Sherman and James C. Dalton, of the Class Journal Co.; Clyde Jennings of AUTOMOTIVE INDUSTRIES; Neal G. Adair, of the *Motor World,* and George E. Quisenberry, of *El Automovil Americano.*

Dodge Tells Dealers of N. A. D. A. Advantages

DETROIT, April 15—Recognition of the National Automobile Dealers Association as the big factor in development of the retail end of the industry, has been given by Dodge Brothers. Letters now are being prepared to be sent out to the 4000 Dodge dealers throughout the country advising them to affiliate closely with the national association and the local dealer organizations which are connected with the parent body.

C. W. Matheson, general sales manager of the Dodge Brothers, in conference with Harry G. Moock, general manager of the N. A. D. A., said that he was anxious to have all Dodge dealers participate in N. A. D. A. activities and expressed the opinion that the organization was a vital force in the industry.

In a statement to AUTOMOTIVE INDUSTRIES this week, Matheson said Dodge Brothers executives fully realized the important work that was being done by the association in behalf of the individual dealer and the entire industry, and declared it would be the effort of that organization to have a full representation of Dodge dealers on the local and national rosters.

Tarkington to Build Light Car in Fall

ROCKFORD, ILL., April 15—The Tarkington Motor Car Co., with a plant already completed in this city, plans to begin the production of a quality, lightweight, six-cylinder car next fall. It will have an overhead motor, carry seven passengers and offer many details in refinements designed to give the car a high saleability.

The company was incorporated about a year ago by P. A. Peterson, who is identified with 25 or 30 different enterprises in this city. The factory manager is J. A. Tarkington, who has been in the automobile business for 21 years, with Rutenber, Apperson, Stoddard-Dayton and Kissel as a production executive. He is a brother of Booth Tarkington, the writer.

The company will make practically all of its own chassis.

EDWIN HALL PARIS DIES

NEW YORK, April 18—Announcement has been received here of the death of Edwin Hall Paris, treasurer and general manager of the Schuman Carriage Co., Ltd., at Honolulu, March 25.

Calendar

SHOWS

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

FOREIGN SHOWS

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina. Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September — Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

May 6—Detroit, N.A.C.C. Advertising Managers Meeting, Detroit Athletic Club.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 23-26 — Chicago, A.S.M.E. Spring Meeting, Congress Hotel.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

July 4-9 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

May 31 — Indianapolis, International Sweepstakes.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Dayton section—May 3.

Indiana Section—May 5.

Washington Section — May 6. Shaped Piston Rings. Cosmos Club.

Midwest Section — May 13. Smoker, Dinner and Entertainment at Chicago Automobile Club.

Dayton Section—May 17. H. L. Horning.

Cleveland Section—May 20.

Chassagne and Wilcox to Drive Peugeots Here

PARIS, April 8 (*By Mail*)—Jean Chassagne has entered a Peugeot racing car for the forthcoming 500-mile grind on Indianapolis track, where he will make his fourth appearance. Officially the Peugeot company is out of all racing for this season, but owing to the intervention of Jules Goux, two of the cars which had been begun for the French Grand Prix have been completed, and one of these has been given to Chassagne and the other to Howard Wilcox. Owing to his business engagements, for Goux is Peugeot agent in Paris, it is impossible for the winner of the 1913 race to come to America this year.

Chassagne's Peugeot is a four-cylinder model of 80 by 148-mm. bore and stroke with cast cylinders and four valves per cylinder in the head, on the same general lines as the pre-war Peugeots. Last year's design, with three camshafts and five valves per cylinder has been abandoned. Weight has been kept down very low and will be only a little more than the minimum imposed by the racing rules. Road tests recently carried out show that the car has a sufficiently high turn of speed to be a possible winner in the Hoosier contest.

Zeppelin Engined Car Wins British Contest

LONDON, April 4 (*By Mail*)—Chief interest at the Brooklands racing season opening Easter Monday centered in the contest between Count Zborowski's six-cylinder Maybach Zeppelin-engined car rated at 600 hp. and the Sunbeam-Coatalen "six" rated at 450 hp. Though the Maybach engined car had 150 hp. more to its credit on rating, it was given four seconds start over a 5¾ miles distance, and for the first quarter of a mile its time was only 15 3/5 seconds.

Going round it increased speed, and starting the descent seemed to perform a little leap in the air and a swerve. The crowd caught its breath, but the driver (the owner himself) got straight in an instant, and on the bank on the far side of the course he "let her go" and flashed by all the other competitors, racing home an easy winner from the Sunbeam. The official speed was given as 100.78 m.p.h.

Advertising Managers to Map Out Campaigns

NEW YORK, April 18—Directors of the National Automobile Chamber of Commerce have authorized a meeting of all advertising managers at the Detroit Athletic Club, Friday, May 6. The purpose of the meeting is further co-operation between the educational department of the N. A. C. C. and the advertising men of the motor car companies together with one or two papers of a definite character. This program will be followed by a series of five minute talks on plans and methods to be pursued in motor car and motor truck advertising for 1921. The meeting is designed not only to consider the best advertising policies to follow to increase sales but to consider those things which must be done further to sell the public on the position of the American vehicle in American life.

Racers Assigned Places in French Grand Prix

PARIS, April 8 (*By Mail*)—Ralph de Palma, on an eight-cylinder Ballot, and René Thomas, on a Sunbeam with the same number of cylinders, will be the first pair to be sent away in the French Grand Prix race—the first of its kind since 1914—at 9 o'clock on the morning of July 25. The start of the race will be given in pairs at intervals of 30 seconds.

After having completed a set of four-cylinder racing cars the Fiat company has built a series of eight-cylinder engines which have just completed their bench tests and probably will be used in the Grand Prix.

Metropolitan Section Hears Carburetion Talk

NEW YORK, April 15—The Metropolitan Section of the Society of Automotive Engineers, at its regular monthly meeting, planned to discuss the subject, "Carburetion of Low Grade Fuel," but the papers of the evening dealt largely with the kerosene carbureter developed by the authors, H. R. Beach and A. J. Weiss, and failed to develop the subject broadly. In consequence, many of those who attended the meeting in the expectation of hearing an engineering discussion along basic lines were disappointed.

Results of the canvass of the mail ballots cast in the annual election of Section officers, announced at the meeting, showed substantially unanimous choice of the regular ticket. Harrold Slauson, the newly elected chairman, was also elected to serve as the Section's representative on the parent Society's nominating committee, which will meet at the S. A. E. summer meeting in West Baden, Ind.

C. F. Scott, chairman of the S. A. E. meetings committee, and President David Beecroft, briefly outlined the plans for the summer meeting.

Advance-Rumely Starts New Truck Division

BATTLE CREEK, MICH., April 15—The new farm truck division of the Advance-Rumely Co. is now in operation here. The department, formerly in Clearing, Mich., has been moved here to replace the threshing machine department. Besides the new truck the plant will also make the Oil-Pull tractor. Working forces will gradually be increased.

According to present plans the truck will be built without the engine because officials have not yet decided on the type and specifications wanted. Officials are optimistic over the future since they declare the farmer is turning fast to motor driven and improved farming machinery and should again be buying heavily soon.